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VOLUME III

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BY

SIR SPENCER WELLS, BART., F.R.C.S.

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CANCER AND CANCEROUS DISEASES.

LAST year, Sir James Paget delivered for the first time the Morton Lecture on cancer and cancerous diseases. He dedicated his published lecture to Mr. John Thomas Morton, of Caterham Valley, "with sincere respect for his benevolence and generosity," and expressed the hope, which he believed Mr. Morton entertained, that this lectureship may lead to some practical utility, "perhaps even to the finding of a method for the prevention or the cure of these diseases." No body of men can be more anxious to assist in the attainment of this philanthropic desire than are the fellows and members of this college. Not one of us needs to be reminded of the almost overwhelming importance of the subject. Cancerous diseases are as heart-breaking to the surgeon as they are mysterious and terrible to the public. And additional reasons for urging the importance of their study now may be found in the fact that, notwithstanding the great advance in sanitary science and the prolongation of the average length of human life—in spite of the shortening of the duration and the lowering of the mortality of some diseases, the prevention, almost the stamping out, of others—cancerous diseases, so far from being less prevalent or less fatal, are increasing among us. The increase in the number of deaths from cancer is now, and has been for many years past, greater than the proportional increase of population. Doubts have been expressed whether this increase is real or only apparent, and due to more complete and accurate registration of the causes of death. This is such an extremely important question that I feel bound to ask for your attention for a few minutes while I lay before

... facts which may assist us in arriving at the truth. ... seventh annual Report of the Registrar-General of ... Births, and Marriages in England was presented to ... in 1886. It contains returns of the deaths in 1884. ... find that the mortality from cancer was higher in ... than in any previous year. We also learn that in three ... periods of ten years, from 1851 to 1880, and in the ... following years to 1887, there has been a gradual in... of mortality from cancer—an increase common to both ... but considerably greater in males than in females. Up ... age of twenty-five, the cancer mortality is small in both ..., but at all age-periods after the twenty-fifth year the ... is much higher of females than of males: and in ... sexes there is a rapid rise of cancer mortality at all ages ... twenty-five years. I am very unwilling to trouble you with figures, and yet the story they tell of increased and increasing mortality from cancer in England and Wales is so full of interest that I feel bound to ask you to glance at the tables before you, which I have prepared partly from published reports, and partly from information kindly supplied to me officially.

The first statement I wish to place before you is the fact that the number of deaths from cancer in England increased from 7,245 in 1861 to 17,113 in 1887. We know that the population increased largely during the same period; but, making the necessary correction for increase of population, and estimating the proportion of deaths from cancer to one million persons living, we arrive at remarkable results. This table shows the number of deaths from cancer in England to one million persons living in the last twenty-seven years, and I am able, through the kindness of Dr. Grimshaw, to compare the Irish and English returns for the last eleven years:—

Year.	England.	Year.	England.
1861	360	1869	417
1862	361	1870	424
1863	361	1871	423
1864	386	1872	436
1865	372	1873	444
1866	385	1874	461
1867	392	1875	471
1868	402	1876	473

Year.	England.	Ireland.	Year.	England.	Ireland.
1877	488	350	1883	546	400
1878	503	360	1884	560	390
1879	502	340	1885	566	390
1880	514	340	1886	583	410
1881	520	370	1887	606	430
1882	532	370			

I think it hardly possible that this steady increase in twenty-six years from 360 to 606 deaths from cancer among each million persons living in England and Wales during that period can be truly attributed to any great extent to better registration. You see that in some successive years the mortality is almost exactly the same; but, on the whole, the increase is much more steady and regular than any modification is likely to have been in the views or habits of those who certify and those who register the causes of death.

And if we arrange the figures in groups of years—three, five, and seven years—from 1858 to 1887, the same steady increase is even more manifest. Here is the annual death-rate from cancer to a million persons living, from 1858 to 1887 and a comparison with Scotland for five of these periods:—

	England and Wales.	Scotland.
Three years (1858–60)	335	—
Five " (1861–65)	368	404
Five " (1866–70)	404	428
Five " (1871–75)	446	468
Five " (1876–80)	495	504
Five " (1881–85)	545	540
Two " (1886–87)	595	—

A glance at the first table shows that up to 1884 the mortality had reached 560, but was up to 606 in 1887. These are the returns of all ages. If we disregard the few deaths in the earlier years of life, and confine our attention to the deaths in persons of twenty-five years of age and upward, we may compare the period of thirty years before 1880 with the seven following years.

Here is the comparison:—

	Both Sexes.	Males.	Females.
Thirty years (1851–80)	867	561	1144
Seven " (1881–87)	1229	895	1533

Surely this great increase in recent years, both among males and females, suggests an urgent need both for inquiry and explanation. I should remind you, before passing on, that if the English population consisted of an equal number of males and females, the annual death-rate from cancer per million of persons of both sexes, aged twenty-five years and upward, would be 1,214 instead of 1,229.

In order to compare England with Ireland, I have examined the last Report of Dr. Grimshaw, the Registrar-General for Ireland, and with his obliging assistance have prepared this table, which shows what the total deaths from cancer have been in England and Wales and Ireland in the eleven years 1877 to 1887 at all ages:—

Year.	Deaths in England and Wales.	Deaths in Ireland.
1877	12,061	1,873
1878	12,594	1,913
1879	12,722	1,782
1880	13,210	1,775
1881	13,542	1,909
1882	14,057	1,882
1883	14,614	1,995
1884	15,198	1,947
1885	15,560	1,925
1886	16,243	2,029
1887	17,113	2,067

On the whole, a smaller increase in eleven years in Ireland than in England and in some years a diminution in Ireland. If we inquire how this is affected by the number of the population, we find that an increase of the number of cancer deaths from 1,873 to 2,067 corresponds with a diminution in population of nearly half a million; and if we calculate the death-rate from cancer, not in persons of all ages, but in those aged twenty-five years and upward, we find that the deaths from cancer registered in Ireland during the seventeen years 1864 to 1880, are equal to an average annual rate of 676 per millon of the living above twenty-five years of age; while those registered during the seven years 1881 to 1887 yielded an average rate of 873 per million. Pray observe—before 1880, 676 per million, and since 1880, 873—surely a remarkable increase, though not so great as in England.

The only years I have yet been able to compare Scotland with Ireland and England are 1883 and 1885, and the figures are—

Year.	England.	Scotland.	Ireland.
1883	546	550	400
1885	546	569	390

These figures represent the proportionate number of deaths to each million of living persons. If we ask only for the total number of deaths from cancer we find that in 1885 there were in Scotland 789 male and 1,384 female deaths—equal to 560 in each million living at all ages—slightly larger than in England, and much larger than in Ireland. In Scotland, with a population smaller by about one million than the Irish, there were some 200 more deaths from cancer. Dr. Cunynghame, in his Report to the Registrar-General for Scotland, remarks that the mortality is highest in Edinburgh and the large town districts, and the proportion varies very much; for while in Edinburgh 49 of every thousand specified deaths are from cancer—in Aberdeen there are 43; Perth, 35; Dundee, 28; Glasgow, in different districts, 21 to 19. Considering that there are large hospitals both in Glasgow and Edinburgh, the fact that deaths from cancer were in 1885 proportionately more than double in one city than in the other is a matter for careful inquiry. By referring to the table of cancer mortality in groups of years from 1861 to 1885 a comparison may be made with the English returns for part of the time—the general result agreeing pretty closely with the Scotch—and both showing a considerable excess over Ireland.

In the United States the recent increase of mortality has been as great as in England. According to Dr. Fordyce Barker, whose reputation here is as deservedly high as among his own countrymen, the mortality from cancer in the city of New York has risen from 400 to the million in 1875 to 530 to the million in 1885. Discussing this increased frequency and mortality of cancerous diseases "in those nations which are the most advanced in civilization," Dr. Barker says that in America these diseases are much less frequent in the colored than in the white race. Hence the mortality is less in the Southern than in the Northern States. "It causes the greatest proportion of deaths where there is the greatest propor-

tion of people of advanced age—that is to say, in the New England States. Hence, in any given locality, a large proportion of deaths from cancer indicates, to a certain extent, that the locality is a healthy and long-settled one, and has a large proportion of inhabitants of advanced age." In this country, it would appear that, although the liability to death from cancer advances rapidly with age, as does the liability to death from other causes (in the words of our Registrar-General), "the characteristic feature of cancer mortality is not its increase with advance of years, for this it shares with other fatal affections, but its disproportionate increase in the middle periods of life."

The fact that these diseases destroy their victims during the most active and useful periods of life surely adds to the importance of studying their causes. When we learn more of their natural history, we shall know better how to avoid or prevent, perhaps to cure them; and we require more information, not only as to the geographical distribution of these diseases in general, as compared with the ages, sexes, and occupations of the populations of different areas, for a sufficient number of years; but it is of equal, perhaps of greater, importance to ascertain how they affect different organs according to locality, race, and habits. For example, cancer of the breast and of the womb may be more accurately recognized, during life and after death, than many other forms of cancer, and if increasing mortality of these seats of the disease were registered in country or any district, it could hardly be denied on the plea of erroneous diagnosis. I may mention a very remarkable fact which seems to prove that in one city at least deaths from these two forms of the disease are not increasing. The city of Frankfort-on-the-Maine is renowned for the completeness and accuracy of its statistics of population, and Hirsch says—in his valuable work on "Geographical and Historical Pathology" (translation for the New Sydenham Society, p. 508): "There has not only been no increase during the twenty-one years 1863 to 1883 in the frequency of those forms of cancer which can be most accurately diagnosed during life or after death, namely mammary and uterine cancer, but indeed a considerable decrease when we allow for the fact that the population has almost doubled during that period." The British Medical Association addressed the Registrar-

General last year, arguing that "the only means which offer a reasonable prospect of discovering how far the increase in the deaths from cancer is real or only apparent, lies in the tabulation, through a course of years, of the cancers of each part of the body separately." In support of the application for such additional returns, the Association urged that they might lead to further knowledge of the causes of the disease, and said: "Your returns have already shown that the increase is greater among men than among women; you may further discover that men of certain trades and employments are more liable than others to the disease, that cancer of certain organs is increasing, while that of all other parts of the body remains stationary, with similar information of equal, or even greater, value" (Brit. Med. Journ., Nov. 12, 1887).

The Registrar-General in his reply relied upon what he called "the great and regrettable lack of precision with which very many members of the medical profession state causes of death in their certificates," as one reason for not tabulating under any but "wide and general headings." Another plea, that he cannot entertain any proposal which would lead to the employment of additional clerks, is surely feeble. No Government could refuse some slight addition to the estimates for a really useful purpose. The opinion, as stated by Dr. Ogle, that some part of the increased mortality under the heading "Cancer" is due to "improved diagnosis and more precise statement of cause" may be quite true; but it is believed that more detailed statistical returns would assist us in determining whether these reasons account for little or for much of the increase and for how much. I can hardly doubt that the required information for England and Wales will be obtained if the Registrar-General has sufficient funds placed at his disposal by the Government. Dr. Grimshaw, the Registrar-General for Ireland, has already begun to obtain and supply the needful information. In his report for the year 1887 he has published a table which shows the deaths from cancer registered during the year, by sexes and age-periods, arranged according to the part of the body affected by the disease, so far as that information was contained in the returns. In 406 cases, the organ or part of the body affected was not stated, and it is important to note that of the 1,661 cases where the required information was given, 507 (or nearly a third) were

from cancer of the stomach. As twenty-nine other cases are returned for the pylorus, the proportion is still larger. There were 203 (or about an eighth) from cancer of the breast; and 161 (about a tenth) from cancer of the uterus. Next in order follow the liver, tongue and lips, throat, intestines and rectum.

When we are able to compare such returns from Ireland with similar information from England, Wales, and Scotland, we may surely be assisted in our study of the causes and prevention of these diseases.

I am sorry that I cannot do more than ask you to glance at Mr. Haviland's interesting charts, which show how very greatly the geographical distribution of cancer and phthisis differ in Great Britain. His writings on this subject merit your careful attention, especially those in the first volume of the "Lancet" for this year.

It would be unjust to Dr. Ogle if I were not gratefully to acknowledge the value of much that he has already done, and accept it as a proof that more will follow. His observations on the varying mortality from cancer in the different counties of England, on the excessively high cancer mortality in London and the surrounding counties, and in many of the counties on the eastern half of the kingdom, and his cautious examination of the truth of the widely spread belief that "cancer mortality is lowest on the western side and highest on the eastern side of England," merits our hearty thanks. If the Registrar-General have power enough, and the expenditure of his department is not stinted, there is ample ground for hope that all required information will be obtained and given. But we must also do our own share of the work. Complaints, not altogether unfounded, are made that the profession does not supply the necessary data for accuracy of statement. It is said that not only country general practitioners, but men of high standing in London, and officials in our great hospitals, are very careless in the matter of filling up death certificates, and yet are angry when they cannot find the precise detailed statistics they desire to obtain. All this is worthy of your careful consideration, and I cannot think I am wrong in the confident belief that hereafter members of our profession in all parts of the country, as well as our associations and medical societies, will assist the Government by freely giving their careful attention to the accuracy of the returns they make as

to the causes of death, and will assist willingly and to the best of their power in the attainment of an object of such national importance. Although some inquirers have not yet obtained all the statistical information they want, I do not think it can be denied that—in regard especially to cancer—there are no statistics in the whole range of medical literature which can be compared, for fullness or for accuracy, with those given in our Registrar-General's last annual report. Not only are those returns founded on a far wider basis than any others, but they stand alone as the only statistics of cancer in which the necessary correction for age-distribution has been made—a correction without which all statistics as to the comparative frequency of cancer in the two sexes, or in different geographical areas, are almost valueless.

The time and attention you have given to these figures, and the inferences drawn from them, will not be lost if you are led, by the belief that cancer and cancerous diseases are increasing, to ask, Can the increase be checked? What are our duties as surgeons in relation to these diseases in general, and to their surgical treatment when different organs or parts of the body are attacked by them?

Upon the general question of the nature and causes of these diseases, of their prevention or the means of checking their increase, I can only speak in the most hasty manner—partly because I could add very little to what Sir James Paget said last year and to the concluding sentence, Mr. President, of your own Bradshaw lecture in this place. You there say, "Before we shall ever be able to answer the question, Why or how do tumors form? we must be able to solve the problem of normal growth and development, and to answer the question, Why or how it is that these continue up to a certain point, and then suddenly cease?"

If I were to attempt to add to this, it would be necessary to review the progress of scientfic pathology in our own time, and to criticise what is known, or believed, or taught in our schools, of the processes which lead to the formation of new growths, especially of those growths which are in their character infiltrating, spreading, invading, encroaching upon or supplanting, surrounding structures, and which may secondarily affect distant parts of the body. The problem is, how

these growths take the place of normal tissues or structures, how their cellular elements appear in the interstices of normal textures, how the normal cells are altered or transformed, how the infecting cells are only misplaced and proliferating epithelium, not new elements, but imperfect or morbid epithelium which has acquired the power of infecting the neighboring cells, or of impressing upon them an epithelial type. You see in this drawing "cancer-cells" arising interstitially from connective-tissue cells which had reassumed their embryonic plastic character. This is the teaching of Virchow, and, though not easy to explain, seems to be in accordance with what the microscope shows us. These are problems which it would be hopeless to attempt to discuss in an hour. If we go a little further back, and study the whole cycle of changes from the cellular rudiments of organs and tissues, through

their normal growth and development toward their natural decay and death, and bear in mind the liability of some of these organs to premature obsolescence, the occasional persistence or return to embryonic forms or powers, and the risk attending the survival in the body of rudimentary structures, we open a fruitful line of inquiry. And if we combine the study of this elemental and cellular pathology with that of the changes in the blood and blood-vessels and in the nervous system modified or not by the influence of hereditary tendencies, and associated or not with the action of chemical or organic agents introduced from without, with the inoculation and multiplication of micro-organisms, and with the poisonous animal alkaloids and extractive compounds which they secrete and leave behind after their work has been done, we have a new world before us, a boundless sphere for continuous research. I know of no path of original research where more

advance is to be hoped for, and none where the assistance freely offered to earnest workers in the new laboratories of this college, which are the first fruits of the bequest of Erasmus Wilson, is more likely to be rewarded by profitable discovery.

I scarcely need do more than mention the great assistance which workers may obtain from the museum of this college. In the original Hunterian Collection there were 287 specimens of cancerous diseases. To these, 1200 have since been added. Microscopic specimens, showing the structure of various forms of these diseases in different organs and tissues, may also be studied in a collection of several hundred prepared by Mr. Eve, who has nearly finished a complete catalogue of the collection. The valuable collection of Hunterian drawings has been enriched, at the suggestion of Sir James Paget, by many illustrations of morbid anatomy. And, quite recently, Dr. Matthews Duncan has presented a large and beautifully executed collection of water-color drawings of cancerous and other diseases of the vulva. Some of them are on the table, and will, I hope, stimulate many to follow so good an example.

Although the hour is rapidly approaching its end, I must not pass over without remark recent discussions as to the supposed microbic origin of cancerous growths. Cases of acute cancerosis or miliary cancer, analogous to acute tuberculosis or miliary tubercle, have led to the search for a specific microbe, or bacillus. Scheurlen believes he has found one, but nearly all those who have examined his statements have been led rather to negative than to confirm his conclusions. Senger, indeed, has almost proved that Scheurlen's cancer bacillus is nothing more than a potato bacillus—one which grows readily on slices of potato, and is often accidentally found there. So far as inoculation experiments, or grafting of portions of cancerous growths upon sound parts of the body, have hitherto gone, they are certainly against the microbic doctrine. We can only admit that any disease is caused by a microbe when the micro-organism has been isolated, has been cultivated outside the human body, and then, when the cultured organism has been introduced, it has led to an identical form of disease or growth. Unless these three things are done we have no positive proof that a disease is due to specific germs.

Knowing how keenly such questions as these are now dis-

cussed, I was anxious to know if the great leader of German pathologists has yet arrived at any definite conclusion regarding them. So I wrote to Professor Virchow, and he replied on October 25 last, sending me a paper published in his Archives on the "Diagnosis and Prognosis of Carcinoma," and adding, "Since I wrote that paper last December, the only progress in the knowledge of Scheurlen's bacillus was its detection growing on potato sections without cancerous origin." Professor Virchow also refers me especially to a part of his paper which expresses his present belief that "the most scrutinizing investigations have not yet arrived at a convincing demonstration." But, with equal caution, he adds that the possibility of the existence of such a micro-organism cannot simply be denied; and that the discovery of a specific bacillus would be of the greatest importance in the diagnosis and prognosis of carcinoma, because, he says, "The attempt to explain all the stages of cancer proliferation with dissemination and metastasis by the dispersion of cancer cells is by no means so certainly supported by anatomical or experimental proof as to exclude any other mode of explanation. Nor, on the other hand, is the need for a cancer bacillus so great that without it we are deprived of the possibility of understanding the process. Animal or human cells, quite as well as bacteria, have the power of influencing metamorphosis, and of producing effective secreted matters of the most various kinds. Why, then, should such an influence be denied to cancer cells, which in many, and especially in the worst cases, are in such a marked degree endowed with the character of gland-cells?"

I would refer any who may wish to study this part of the subject to some extremely valuable papers by Mr. Ballance and Mr. Shattock published in the Pathological Transactions for this year and last year, and especially to their reports of cultivation experiments with malignant new growths made to the Collective Investigation Committee of the British Medical Association. Although in their attempts to propagate the disease by inoculation they have not yet succeeded, they still hold ("British Medical Journal," October 29, 1887) that "the parasitic theory in some form or other is the most probable of any of those yet advanced." What they now desire is that inoculated animals should be kept for the full term of their natural life under healthy sanitary conditions; as the life-his-

tory of the parasite may be a long one, and it may be a long time before the characteristic effects of inoculation could be expected.

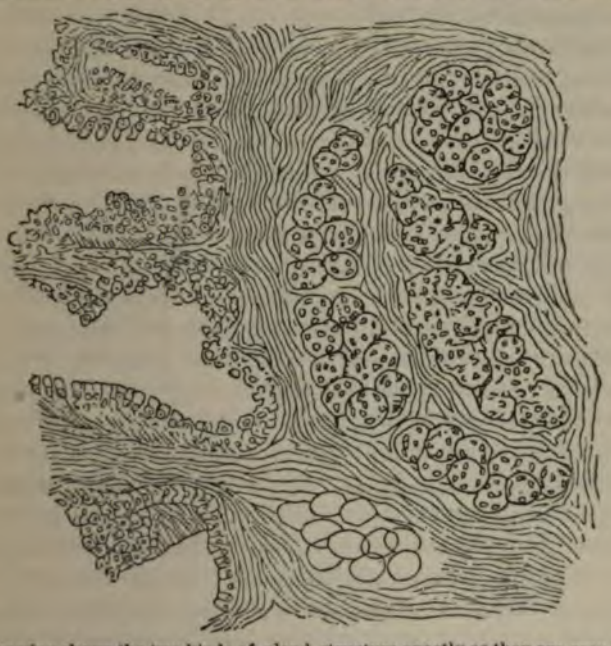
The time at my disposal is so very short that I must at once pass on to the consideration of our duty as surgeons in treating sufferers from cancerous diseases, and I propose to ask you to reflect at your leisure upon certain questions about which the mind of the profession is still not definitely settled, rather than to accept any conclusions of mine.

The first of these questions is whether a cancerous growth alone, or the whole of the part or organ which it has invaded, should be removed; and I think the time has come to agree upon some general rule or principle of treatment. With regard to cancer of the breast, two very opposite opinions are held by men of high position as hospital surgeons. Mr. Nunn, after very large experience at the Middlesex Hospital, in his admirable treatise on "Cancer of the Breast," says .(p. 32): "When an operation has been decided upon, the removal of the entire mammary gland must be complete, any partial removal is not only useless but worse than useless; the occurrence of the slightest speck of cancer in a gland declares that the whole organ is more or less ready for special degeneration." Mr. Butlin, whose experience at St. Bartholomew's is also very large, and whose work on the operative surgery of malignant disease is rich in facts carefully tested and in conclusions drawn with remarkable judgment and freedom from prejudice, takes a very different position to that of Mr. Nunn. He says that in many cases the tumors are "at first of small size, limited to a part of the breast, often situated toward the margin of the gland" (p. 381); and he adds: "Just as good reason could, I am sure, be given for the removal of both breasts in every case of cancer of one of them, as for the removal of the entire mammary gland in every instance." Time prevents me from entering further upon this important practical question than to say that my own practice, and what I have actually seen of the practice of others during the past thirty years, would lead me to remove the entire breast in every case of cancer, except where the growths are small and close to the margin of the gland, or only affect outlying portions of the gland. And when such growths are found not in the gland,

but in the axilla, I should strongly oppose removal of the breast, because I think such tumors may be neither of the breast itself nor of the axillary lymphatic glands, but of a certain class of sweat-glands which have been the subject of a paper by Dr. Creighton. I believe it is only necessary to direct more attention to this inquiry to lead to the recognition of a new and a large class of tumors of the axillary and pectoral regions.

The tumors to which I allude are found at the outer border of one or both breasts, and the surgeon is doubtful whether the breast itself is or is not involved in the new growth. When the growth is between the outer border of the mammary gland and the corresponding axilla, the fear is felt that the axillary glands are involved in the breast disease: and opinions are given that both the axillary tumors and the breast should be removed. Such a case came before me scarcely a month ago. On the 25th of last month, a married lady, who had never been pregnant, forty-six years of age, came to me from Wales, having had a strong opinion that her right breast should be removed without delay. I found both breasts larger and harder than usual, both nipples unusually large and prominent, but the only distinct tumor to be felt was between the upper and outer border of the right mamma and the axilla. Extending from this border, below and behind the pectoral muscle, was a round, movable, tender tumor about three inches in lateral and two in vertical measurement. It was in close connection with the mammary gland; but I thought I could separate one from the other. The patient felt sure that a blow from a tennis ball two years ago had been the cause of the swelling. I advised that neither of the breasts should be removed; but that the tumor or tumors, whatever they might be, should be removed without delay. Meeting Dr. Creighton later on the same day, I mentioned the case to him, and he at once suggested that the tumor might be neither of the breast nor of the axillary lymphatic glands, but of certain sweat-glands below the skin of the axilla which he had referred to in connection with tumors in a paper which was read at the Royal Medical and Chirurgical Society six years ago, and may be found in the sixty-fifth volume of the Transactions of the Society. In that paper he shows that the special layer of glandular substance more or less developed in the human

axilla, corresponds to a conglobate form of gland not previously described, in one of the lowest mammalians, with an investment of unstriped muscular fibres in parallel order around each crypt, so as to constitute a basement membrane upon which the epithelial cells are seated. These sweat-glands differ in important respects from the ordinary skin glands of man. They are not usually in the substance of the skin, but adhere to its under surface, lying between the skin and the axillary



This drawing shows the two kinds of gland structure exactly as they are seen in one of Dr. Creighton's preparations. To the right is seen a portion of a mammary lobule in a resting state; and, on the left, a scattered deposit of the so-called sweat-glands, with muscular basement membrane.

fascia, and sometimes extending to the lateral and anterior regions of the chest. They are variously developed in different individuals, and must be regarded as a sort of survival or rudimentary organ, and subject to all the risks of such survivals or rudiments. Dr. Creighton says: "I have, in one instance, found perfect examples of them in intimate association with the breast structure."

I show you here the tumor which I removed entire on October 30, as well as the fragments of another somewhat smaller

tumor, and the tissue I removed in dissecting away the investing membrane after the interior had been cleared out. Dr. Creighton was present, and made a careful examination on the same day of all that I removed. The smaller or pectoral tumor was so closely connected with the breast that I removed with it a small piece of the outer border of the gland, enough to show that the breast itself was quite healthy. In order to be sure of removing the whole of the tumors, I removed some of the surrounding fat also, and Dr. Creighton reported to me that he found "embedded" in the fat, round, reddish bodies, about the size of a large pin-head. "One of these, easily extracted from the surrounding fat, proved to be a coil or cluster of the tubular axillary glands of perfectly normal structure, in which the characteristic palisade-like basement membrane of unstriped muscular fibres, the mosaic of polyhedric epithelium resting on the latter, and the conglobate windings and crypt-like recesses of the tubule were easily seen in a preparation of the fresh tissue. The capsule of the smaller and more friable new growth adhered along the axillary side of the piece of fat, the normal reddish cluster of glands lying in the fat about an eighth of an inch deeper. This capsule was everywhere infiltrated with blood; its inner surface was not uniform, but subdivided into a number of round areas or recesses of unequal size, one or two of which were specially marked by their black pigmentation. The examination of that capsular tissue, and of the friable tumor tissue which was removed from it by the finger during the operation, discovered satisfactory evidence of the same glandular structure as in the small reddish body embedded in the adjoining fat—namely, unstriped muscular fibres, spherical or polyhedric epithelium, with or without brown or black pigment, and, in sections, traces of the tubular glands themselves.

"The larger mass of tumor was situated deeper in the axilla, and was unconnected with the portion nearest to the breast, except by loose tissue. It was extracted by the fingers entire, an encapsuled lobulated oval body, about two and a half inches in its long axis, and an inch and a quarter across at its thicker end. The surface was everywhere dark red, giving it some resemblance to a small kidney. In its lobulation it looked like a packet of lymphatic glands. On section it proved to be a whitish medullary substance with a few small

areas of pigmentation, and with a general foliaceous or lobulated arrangement of the stroma. In microscopic preparations of the fresh tissue, unmistakable examples of unstriped muscular fibres were found, as well as the same polyhedric and spherical epithelium, with and without pigment, as in the more friable tumor nearer to the breast. In sections the epithelial cells were found collected in alveolar heaps, generally of great extent. The dark color of the capsule was from infiltration of blood."

The general structure of these tumors of the irregularly scattered sweat-glands, including their hæmorrhagic capsule, appears to be the same that has been described for the puzzling class of cases known as "alveolar sarcoma of the breast," or "duct-cancer of the breast." It is noteworthy that these cases have sometimes been found to start from the areola around the nipple, a region which is known to be provided with the same kind of tubular glands as are found in the axilla. When such growths ulcerate they resemble rodent ulcer. The so-called eczema of the nipple, which has been observed in such cases, would appear to be connected with the orifices of the gland, and, in its simpler forms, to be little more than the brownish secretion of the glands dried upon the skin. It seems probable that this case, and Dr. Creighton's observations upon it, will be the beginning of a new classification—or of the separation of such cases from the class of mammary tumors, and their reference to the irregular deposits of sweat-glands of the axilla, and to the glands of the areola.

I may add that a tube draining away from the axilla was kept in for three days, and after its removal union of the incision, about four inches long, was complete when the sutures were removed The patient returned to Wales a few days after the operation. I have arranged for a report as to any recurrence hereafter, but venture upon a favorable prognosis.

Again, we may be consulted in cases where the period for early and hopeful operation has passed by, or where, months or years after operation, recurrence has taken place—it may be that recurring growths have also been removed, once or several times—and then comes a time when a patient, exhausted by loss of blood, or by profuse offensive discharge, approaches the end, and further operative treatment is abandoned. Are we to be content with relieving pain, prolonging

sleep, and the use of deodorizing or disinfecting appliances, or can we do more? Can we encourage the forlorn hope of the patient that growth may still be stopped? that some benign alteration may take place in its structure—something like the "spontaneous involution" of Virchow—some retrograde fatty change in the cells or elementary components of the tumor, while extension or growth of new cancer cells is stopped? If this could be attained before other parts of the body were infected it would amount to curing cancer. From time to time such cases of cure are reported, but few, if any, stand the test of accurate investigation. Virchow, however, cautions us against too great scepticism in such therapeutical investigations, and says that the hopeless condition of the patient justifies the trial of remedies of whose mode of action we have no clear idea. Whether we can go still further, and secure for healthy tissues immunity against infection from an existing cancer—a resistance to invasion—remains a subject for future inquiry. All we can yet say is, that under certain conditions the nutrition of cancer cells may be so far arrested as to lead to their complete disintegration. This is often observed in small fragments, or within a limited circumference, and Nussbaum has recently succeeded in the attempt to effect such changes in larger growths by cutting off their supply of blood. He makes deep furrows with Paquelin's cautery through the integuments and subcutaneous fat quite down to the adjacent fascia or muscles, thus cuts off all peripheral supply of blood, and so lessens the abnormal vascularity of many malignant tumors. Soft fungoid masses which bleed readily soon become firm, and the whole tumor more solid, while the general health improves and life is prolonged. And we also hear from Munich of aims at a somewhat similar object by injecting solutions of ozone into the substance of cancerous growths and the tissues surrounding them. Not only is the proliferation of the epithelial cells said to be arrested, and the formation of cicatricial tissue obtained, but the surrounding textures are protected against invasion. So long as the disease is local it must be curable. As Virchow says in concluding his last paper, "If cancer in its beginning, and often very long afterward, is a local disease, it must be possible during this period locally to cure it."

When a superficial cancer on a limb has returned after destruction by cauterization or caustics, or after removal by the

knife and grafting of healthy skin, and the lymphatic glands nearer the body remain free from infection, the propriety of amptating the limb must become the subject for consultation. It will sometimes be the painful duty of the surgeon to urge upon a reluctant patient to sacrifice a limb in the hope of saving life; and if this advice is followed before infection of the glands has taken place, the result has often proved the soundness of the advice; while too great delay, or want of earnestness in urging submission to so serious an alternative as the loss of a limb must always be, may lead to protracted suffering and inevitable death.

I have yet another subject for your consideration, one which the general public enters into with a good deal of warm feeling and an amount of ignorance which calls rather for instruction than blame. I mean the removal of cancerous growths by cauterization instead of by the knife. On this point let me read to you what our great master, John Hunter, said just a hundred years ago (Palmer's edition of his works, vol. i., page 625) as to cures for cancer:

"No cure has yet been found: for what I call a cure is an alteration of the disposition and the effect of that disposition, and not the destruction of the cancerous parts. But as we have no such medicine, we are often obliged to remove cancerous parts, which extirpation, however, will often cure as well as we could do by changing the disposition and action. Arsenic seems to have some power of this kind, and its effects might be increased, by being used internally and externally; but its use is very dangerous, and I am afraid insufficient for the disease. This is a remedy which enters into the empirical nostrums which are in vogue for curing cancer; and among which Plunkett's holds the highest rank. But this is no new discovery, for Senertus, who lived the Lord knows how long ago, mentions a Roderiguez and Flusius, who obtained considerable fame and fortune by such a composition. I was desired to meet Mr. Plunkett, to decide on the propriety of using his medicine in a particular case. I have no objection to meet anybody. It was the young one: the old one is dead, and might have died himself of a cancer for aught I know. I asked him what he intended to do with his medicine. He said, 'To cure the patient.' 'Let me know what you mean by that. Do you mean to alter the diseased state of the parts, or do

you mean by your medicine to remove the parts diseased?' 'I mean to destroy them,' he replied. 'Well, then, that is nothing more than I or any other surgeon can do with less pain to the patient.' Poor Woollett, the engraver, died under one of these cancer-curers; he was under my care when this person took him in hand. He had been a life-guardsman, I think, and had got a never-failing receipt. I continued to call on Woollett as a friend, and received great accounts of the good effects, upon hearing which I said, if the man would give me leave to watch regularly the appearance of the cancer and see myself the good effects, and should be satisfied of its curing only that cancer (mind, not by destroying it), I would exert all my power to make him the richest man in the kingdom. But he would have nothing to do with me, and tortured poor Woollett for some time, till at last I heard the sound testicle was gone, and at length he died."

How this story of John Hunter reminds us of much that goes on every year in this great city! More than thirty years ago, in 1857, I published a lecture on the cancer-curers of that day—Pattison and Fell, Landolfi and the Black doctor, Beveredge and the Rev. Hugh Reed. I believe the exposure of Mr. Reed's practice did much to prevent other cancer-curers from doing much harm in London. But there are still irregular practitioners heard of, who follow the line of Plunkett, Pattison, and Fell, who profess not only to destroy a cancerous tumor, but also what they call its roots, and thus prevent a return; or, as Fell professed, to destroy the "tendency existing in many cases in the constitution for the reproduction of cancerous cells," and to "destroy the cancerous diathesis." It is curious to compare this claim with John Hunter's remarks on the use of arsenic to "destroy the cancerous disposition," with Mr. Hutchinson's recent observations on "Arsenic-Cancer," and with Dr. Creighton's views on arsenic among other alterative or "habit-breaking" drugs, metals, or metalloid substances having elective affinities for particular tissues; and this theory of cancer as an acquired habit of the tissues, "a habit that might be broken if we only knew how." The inhalation of oxygen and the use of oxygenated water as a beverage have been supported upon somewhat similar grounds, and did no harm beyond disappointing the patient. But as a fashion its day was short. The use of methodical compression,

which often did good, has led to the more modern *massage*, which has already done much harm. On looking over my old lecture I find this sentence: "I should not be at all surprised to hear that the next great empiric who appears in London will profess to cure cancer by galvanism." I have been surprised that this advent has been so long delayed, although there have been proofs of late that female galvanic doctors are at work, and others calling themselves electro-homœopaths, doing some harm, but not deserving the title of great empirics. While writing this, I hear of certain cancer-curers whose head-quarters are at Brussels, but who have correspondents in London and Southampton, whose practice leads to results quite as bad as any of those of Pattison and Fell. I must not pursue this rather tempting subject further than to repeat my assertion that "we have no reason to fear a comparison between what we can do by fair and open means and what really can be done or ever has been done by any cancer-curer or any secret remedy."

More than ten years ago, in June 1878, lecturing in this theatre, I gave a short account of Freund's method of entirely removing a cancerous uterus through an incision in the abdominal wall, and referred to Blundell's four cases of removal through the vagina. I then said I thought it would be rarely that an entire uterus affected by cancer would be removed by laparotomy; and I need now only add that the results of the practice have been so disappointing that it may be said to be practically abandoned. I have only twice removed the entire uterus by laparotomy, and the specimens in both cases are on the table before you. One is of some historical interest as having been the first instance in his country of excision of the entire gravid uterus. The patient was six months pregnant and suffered from epithelioma of the cervix uteri. You see the entire uterus and the ovaries, just as they were removed, and the opening through which the fœtus was extracted. The patient recovered from the operation and was in fairly good health for several months; but the disease recurred in the left iliac fossa, and death took place thirteen months after operation. The other case was much more satisfactory. A patient at the full term of pregnancy had her pelvis so blocked up by a uterine tumor that delivery was impossible. You see the uterus which I removed with both ovaries, and the cavity

from which a living child was extracted. Recovery was as rapid as after a natural labor, and I received a photograph of mother and child a year after the operation, both being quite well. I need say no more of these cases, as they have both been published, except that they have proved that in case of need the entire uterus, containing a fœtus or a viable child, with considerable tumors, and with both ovaries, may be successfully removed through the abdominal wall.

Removal through the vagina is a much more successful operation. It did not attract serious attention in England until after a discussion at the Obstetrical Society in March, 1885, where it may be said to have been generally condemned. In the report of that discussion I find the following remarks of my own:—

"It is to be hoped that at least as good results may be obtained here as in Germany, and that condemnation of the principle of the operation will not be the verdict of the Obstetrical Society. Have we sufficient facts before us to justify such a verdict? Admitting that abdominal extirpations have resulted in a mortality of 72 per cent., and vaginal extirpations of 28 per cent., is it to be supposed that improved methods will not lead to diminishing mortality? Admitting that recurrence of the disease within a few months, or, at most, in from two to five years, has hitherto been the rule, may not a more accurate diagnosis, earlier operations, and improving methods lead to better results; not only to a lower death-rate, but to a retarded recurrence and sometimes to complete recovery?"

It will hardly be disputed now that the mode of operating has been improved and that mortality has diminished; and I think I cannot employ the few minutes still allotted to me better than in rapidly sketching what I believe to be the best mode of operating, and in bringing before you the results already attained by experienced operators.

But I must first say a few words comparing removal of the entire uterus with removal of the diseased part only, by the operations known as infra-vaginal and supra-vaginal amputations. The diagrams on the next page show what is meant by these alternative proceedings.

Of course it must be difficult to draw a very definite line, and say exactly where one or other of the two operations

begins or ends, but these are near enough for all practical purposes, and if they are compared with this other diagram after Freund, showing what is done when the entire uterus is removed, both Fallopian tubes and both ovaries being left

behind, a very good idea may be formed as to the comparative gravity of the different procedures.

In many cases of total extirpation it may be advisable to remove both Fallopian tubes as well as the uterus, and in

some cases one or both ovaries should also be removed. This will, I need hardly say, depend upon the healthy or diseased condition of the different parts.

I am sure we are not yet in a position to compare numeric-

ally the risks of partial or total excisions neither as regards the immediate danger of death from the operation nor as to the liability to recurrence at longer or shorter intervals. This must be done at some future time when we have a larger number of cases accurately observed and faithfully recorded. At present I can only offer a general statement that in my own practice, when the disease is strictly limited to the parts near the os, I prefer infra-vaginal amputation, and I do it by the galvanic cautery écraseur, using the wire at a low red heat, and tightening the loop very slowly. I have removed nearly the whole of the cervix in this way without losing one drop of blood. A white dry eschar is left, and cicatrization follows without fever or much pain. When disease has extended rather higher, amputation must be done with knife or scissors, but it is well to cauterize the raw or bleeding surfaces by copper or gas cautery or Paquelin's, to serve the double purpose of checking bleeding and destroying any infective cells that may possibly have invaded the tissues above the line of amputation.

Before passing on to the details of the operation of total excision, I must say a few words as to the use of caustics rather than the knife, scissors, or cautery. Potassa fusa has been largely used in this way, and I have heard of, but never seen, very good results following. And I have seen several cases treated by the late Dr. Wynn Williams with bromine. But not one ended satisfactorily, although temporary good was done. On the table is a very remarkable specimen of the entire uterus which sloughed away after the use of chloride of zinc. Dr. Marion Sims carefully scraped away with his curette all the diseased structure till he came upon hard uterine tissue. Then he applied persulphate of iron upon cotton wool, left this for twenty-four hours, removed the styptic plug, applied another plug of wool charged with a strong solution of chloride of zinc, and left this for four days. After removing this plug, antiseptic vaginal injections were used for several days, and then I found this mass quite loose in the vagina. It consists of the entire uterus, and when fresh it was quite evident that some of the peritoneal coat of the fundus came away with it. The patient suffered a great deal, and died about two months after the application of the caustic; sooner, I believe, than if she had been left alone.

After what I have said it cannot be surprising that in any case where cancerous disease has extended much higher than the os, and there is good reason to believe from the mobility of the organ that the surrounding tissues are still free from invasion, I advise total excision as the best practice. And increasing experience is materially simplifying the operation. I cannot pretend now to describe the different steps in detail, and I need only allude to the importance of preliminary disinfection of the vagina, removal of any dead or softening cauliflower excrescences, and shaving off all hair from pubes and vulva. This may be done the day before operation.

During the operation the patient is fixed in the lithotomy position by anklets and wristbands, or by a thigh crutch; and a douche and elastic tube are so arranged that a stream of warm, slightly-carbolized water may continually irrigate the vagina. The body is well covered, as well as the arms, legs, and feet, to prevent chilling. If the uterus is fairly mobile, no speculum is required, at most one or two retractors. Some operators draw down the uterus by a simple or double hook, or by hooked forceps; but if the cervix is firm, any friable part having been cleared away, the safest plan is to pass a strong wire quite through the cervix. This is safe, and not so likely to be cut as silk. Supposing that any intention of turning the fundus either forward or backward is, as it ought to be, abandoned, the cervix is pulled by the wire toward the vulvar orifice, the labia held aside, and the sides of the vagina separated if necessary. The operation is completed by different stages.

1. Division and loosening, and pushing up to the extent of half to three quarters of an inch, of the vaginal mucous membrane behind and in front of the cervix.

2. Pushing upward or separation of the bladder and ureters from the neck and anterior surface of the body of the uterus.

3. Opening Douglas's pouch, and introduction of a sponge to keep up the small intestines.

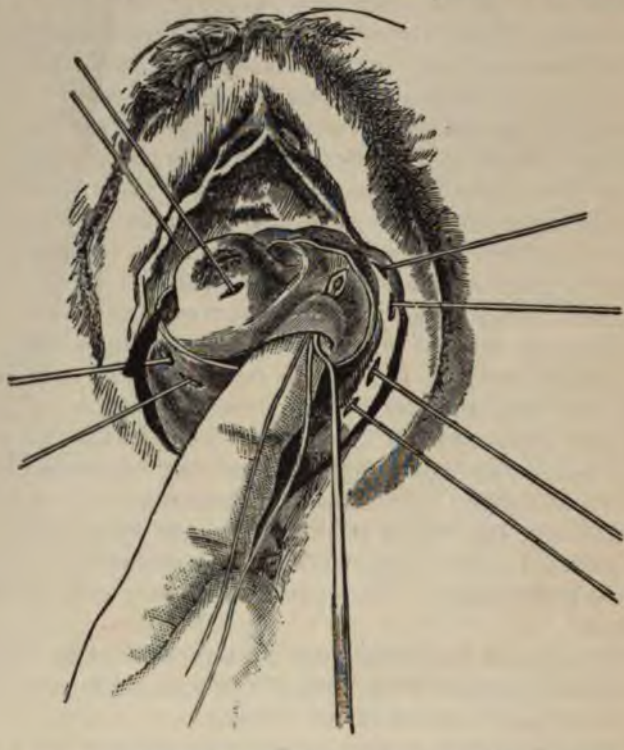
4. Securing the uterine arteries on both sides by ligature or by pressure forceps.

5. Division of the broad ligaments and other attachments, and removal of the uterus.

6. Cleansing vagina, removal of sponges, arranging ligature threads or forceps, and loose plugging with iodoform gauze.

It is unnecessary to such an audience as this to enter into further detail; but I will refer briefly to two matters of great importance—the safety of the bladder and ureters, and the substitution of forcipressure for the ligature.

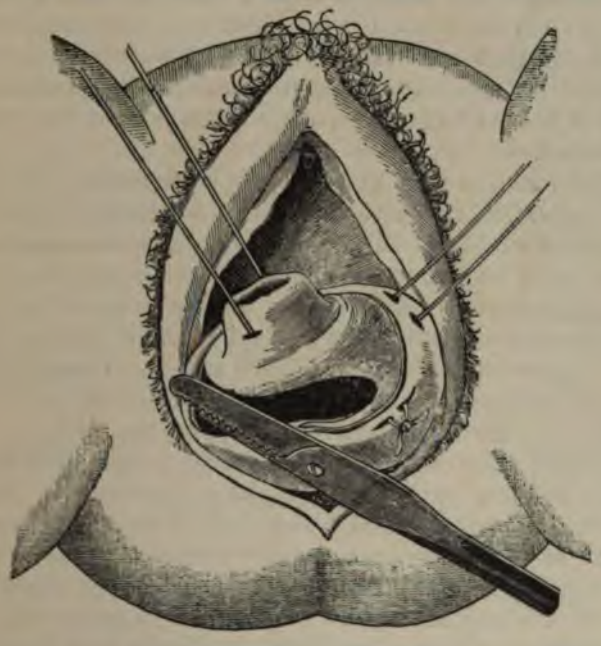
Sometimes the separation of the bladder from the uterus is quite easy, sometimes very difficult, and I am sure great care is always required to avoid the ureters. In several re-



corded cases one, and in more than one case both ureters have been tied or divided. I need hardly remind you that one mode of death in uterine cancer is uræmic coma, caused by closing up of one of both ureters. And I show you here the parts removed after the death of a patient from uræmic coma. She was operated upon by a very experienced American surgeon for vesico-vaginal fistula, yet one ureter was included in the sutures which closed the fistula, and the other was left opening into the vagina behind the united edges of the fistula. In

some recorded cases the bladder has been wounded, and in others the catheter or sound passed through the urethra, and used as a guide to the separating finger or to pull the bladder forward, has been seen through the thin muscular coat and mucous membrane of the bladder.

In one of these drawings the mode of passing one of the ligatures used to secure the uterine arteries is shown—a threaded blunt needle is guided by one finger passed into Douglas's pouch. One or more may afterward be passed in



the same way to secure the broad ligament on either side, or the same object may be gained by the use of pressure-forceps, as shown in the next drawing. These are not removed, but are left on for twenty-four, thirty-six, or forty-eight hours until all danger of bleeding has ceased. Leopold and some German operators prefer the ligature. Péan, Richelot, and other Frenchmen trust to the forceps. I believe I was the first to suggest their use, and one of our Fellows, Mr. Jennings, the first in this country to carry out the suggestion with success. Some warm controversy has arisen in Paris

ately on this matter, and Dr. Pozzi, in a small work on vaginal hysterectomy for cancer just published puts the historical question as follows. After quoting what I wrote in 1882 ("Ovarian and Uterine Tumors," p. 526) recommending the "securing any bleeding vessel as it is divided by pressure-forceps, not using any ligatures, but leaving the forceps hanging out of the vagina for two or three days until all danger of hemorrhage has ceased," Dr. Pozzi refers to Mr. Jennings's successful case in October, 1885, before M. Richelot's first case in April, 1886, but after M. Péan's first in June, 1885, which was not published until April, 1886, and concludes that, although M. Richelot has "vulgarized" forcipressure in this operation, Mr. Jennings's case had been published nine months before M. Richelot made his communication to the Academy of Medicine.

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When these ligatures are tied they form a chain of compression all round the edges, and may be used afterward by loosely tying some or all of the long ends together to close the opening from the vagina into the peritoneal cavity as far as may be desirable. By crossing their handles pressure forceps would have the same effect. My own feeling would be rather to trust as a rule to forceps, and only exceptionally to ligatures. Forcipressure is simpler, more secure, takes much less

time, and saves much suffering to the patient when sutures are removed. When an operator, who has prepared himself for the operation by sufficient practice on the dead body, trusts to forcipressure and has arranged everything before he begins, I feel sure that fifteen or twenty minutes would give ample time to complete the operation if the ovaries are not disturbed. If healthy, I think they had better be left alone, and so may the Fallopian tubes. But if the disease has extended high up the uterine cavity it would be safe to remove the tubes. And this would add very little to the duration of the operation.

I shall not attempt to give the results of this operation statistically; but it is important that we should know what a few of the most experienced operators have been able to accomplish. Professor Olshausen, of Berlin, formerly of Halle, who has had probably a larger experience of this operation than any other surgeon, informs me that the following table represents the whole of his experience of total extirpation of the uterus *per vaginam* for cancer:—

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The Professor adds: "I very seldom perform supra-vaginal amputation, and only when the carcinoma is limited to the *portio vaginalis*. Of my cases done in 1881–82, I have one who has remained free from recurrence for seven years, two others have been free for five and a half years, and one for five years. Professor Leopold wrote to me on the 11th of this month, stating that up to that date he had performed total extirpation of the uterus by the vagina in eighty-three cases with only five deaths, a mortality of six per cent. Péan, writing on the 13th, says that from 1882 to the end of 1887 he had done twenty-two operations, fifteen successful, and with seven deaths; but that this year he has had sixteen cases, all successful and no deaths. Martin, of Berlin, who had previously published sixty-six cases where cancer led to the operation,

ally the risks of partial or total excisions neither as regards the immediate danger of death from the operation nor as to the liability to recurrence at longer or shorter intervals. This must be done at some future time when we have a larger number of cases accurately observed and faithfully recorded. At present I can only offer a general statement that in my own practice, when the disease is strictly limited to the parts near the os, I prefer infra-vaginal amputation, and I do it by the galvanic cautery écraseur, using the wire at a low red heat, and tightening the loop very slowly. I have removed nearly the whole of the cervix in this way without losing one drop of blood. A white dry eschar is left, and cicatrization follows without fever or much pain. When disease has extended rather higher, amputation must be done with knife or scissors, but it is well to cauterize the raw or bleeding surfaces by copper or gas cautery or Paquelin's, to serve the double purpose of checking bleeding and destroying any infective cells that may possibly have invaded the tissues above the line of amputation.

Before passing on to the details of the operation of total excision, I must say a few words as to the use of caustics rather than the knife, scissors, or cautery. Potassa fusa has been largely used in this way, and I have heard of, but never seen, very good results following. And I have seen several cases treated by the late Dr. Wynn Williams with bromine. But not one ended satisfactorily, although temporary good was done. On the table is a very remarkable specimen of the entire uterus which sloughed away after the use of chloride of zinc. Dr. Marion Sims carefully scraped away with his curette all the diseased structure till he came upon hard uterine tissue. Then he applied persulphate of iron upon cotton wool, left this for twenty-four hours, removed the styptic plug, applied another plug of wool charged with a strong solution of chloride of zinc, and left this for four days. After removing this plug, antiseptic vaginal injections were used for several days, and then I found this mass quite loose in the vagina. It consists of the entire uterus, and when fresh it was quite evident that some of the peritoneal coat of the fundus came away with it. The patient suffered a great deal, and died about two months after the application of the caustic; sooner, I believe, than if she had been left alone.

After what I have said it cannot be surprising that in any case where cancerous disease has extended much higher than the os, and there is good reason to believe from the mobility of the organ that the surrounding tissues are still free from invasion, I advise total excision as the best practice. And increasing experience is materially simplifying the operation. I cannot pretend now to describe the different steps in detail, and I need only allude to the importance of preliminary disinfection of the vagina, removal of any dead or softening cauliflower excrescences, and shaving off all hair from pubes and vulva. This may be done the day before operation.

During the operation the patient is fixed in the lithotomy position by anklets and wristbands, or by a thigh crutch; and a douche and elastic tube are so arranged that a stream of warm, slightly-carbolized water may continually irrigate the vagina. The body is well covered, as well as the arms, legs, and feet, to prevent chilling. If the uterus is fairly mobile, no speculum is required, at most one or two retractors. Some operators draw down the uterus by a simple or double hook, or by hooked forceps; but if the cervix is firm, any friable part having been cleared away, the safest plan is to pass a strong wire quite through the cervix. This is safe, and not so likely to be cut as silk. Supposing that any intention of turning the fundus either forward or backward is, as it ought to be, abandoned, the cervix is pulled by the wire toward the vulvar orifice, the labia held aside, and the sides of the vagina separated if necessary. The operation is completed by different stages.

1. Division and loosening, and pushing up to the extent of half to three quarters of an inch, of the vaginal mucous membrane behind and in front of the cervix.

2. Pushing upward or separation of the bladder and ureters from the neck and anterior surface of the body of the uterus.

3. Opening Douglas's pouch, and introduction of a sponge to keep up the small intestines.

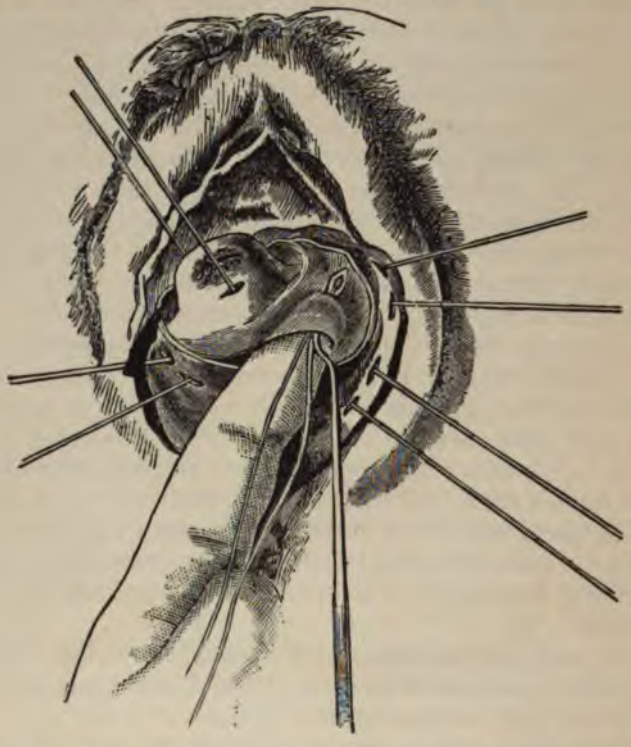
4. Securing the uterine arteries on both sides by ligature or by pressure forceps.

5. Division of the broad ligaments and other attachments, and removal of the uterus.

6. Cleansing vagina, removal of sponges, arranging ligature threads or forceps, and loose plugging with iodoform gauze.

It is unnecessary to such an audience as this to enter into further detail; but I will refer briefly to two matters of great importance—the safety of the bladder and ureters, and the substitution of forcipressure for the ligature.

Sometimes the separation of the bladder from the uterus is quite easy, sometimes very difficult, and I am sure great care is always required to avoid the ureters. In several re-



corded cases one, and in more than one case both ureters have been tied or divided. I need hardly remind you that one mode of death in uterine cancer is uræmic coma, caused by closing up of one of both ureters. And I show you here the parts removed after the death of a patient from uræmic coma. She was operated upon by a very experienced American surgeon for vesico-vaginal fistula, yet one ureter was included in the sutures which closed the fistula, and the other was left opening into the vagina behind the united edges of the fistula. In

some recorded cases the bladder has been wounded, and in others the catheter or sound passed through the urethra, and used as a guide to the separating finger or to pull the bladder forward, has been seen through the thin muscular coat and mucous membrane of the bladder.

In one of these drawings the mode of passing one of the ligatures used to secure the uterine arteries is shown—a threaded blunt needle is guided by one finger passed into Douglas's pouch. One or more may afterward be passed in

the same way to secure the broad ligament on either side, or the same object may be gained by the use of pressure-forceps, as shown in the next drawing. These are not removed, but are left on for twenty-four, thirty-six, or forty-eight hours until all danger of bleeding has ceased. Leopold and some German operators prefer the ligature. Péan, Richelot, and other Frenchmen trust to the forceps. I believe I was the first to suggest their use, and one of our Fellows, Mr. Jennings, the first in this country to carry out the suggestion with success. Some warm controversy has arisen in Paris

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with eleven deaths, or sixteen per cent. mortality, writes on the 16th of this month: "Since the Washington Congress in 1887, I have performed the vaginal total operation in twenty-two instances." (He does not say in how many for cancer.) "All recovered but one, who died of hæmorrhage. Of supra-vaginal amputation I performed altogether six, with one death." It would be easy to collect a very large number of cases: such as Schroeder, fifty-nine, with five per cent. mortality; Fritsch sixty, also seven per cent. But these do not bring us later than 1866, and they all tell the same story of greater success following larger experience.

As to the comparative mortality of infra- and supra-vaginal amputation and total excision, the results vary so much in successive years and in the practice of different operators that I have been unable to collect materials for a trustworthy contrast either as to the immediate fatality or as to the frequency of recurrence of disease. But it certainly appears that recurrence is earlier after partial than after complete operations. In some series the remarkable fact comes out that supra-vaginal amputation stands the test of recurrence better than complete excision. This would be inexplicable if it were not for the probability that the disease had been generally much further advanced in the cases where total excision was performed than in the others.

Our American brethren have been before us in adopting the operation of total excision of the uterus, and, as elsewhere, their results have improved with time and experience.

The cases hitherto performed in this country have not been enough to serve for any comparison of results with those abroad, but they all teach the lesson that if the operation is to be successful it must be done early, before surrounding structures are involved in the disease. In addition to the case of Mr. Jennings, of which I have spoken, Dr. Purcell has had five successful cases; Dr. Sinclair, of Manchester, four; Mr. Reeves, Dr. W. Duncan, and Dr. Keith, one each; and I dare say other cases might be found by searching the medical journals of the last three or four years.

There are other parts of this subject on which I should like to say much more. I have alluded to Mr. Haviland's work on the geographical distribution of cancer, and now I can only point to these two of his maps which show how in

certain districts of this country the mortality from cancer is high, and from phthisis low, and the exact reverse in other districts. I wished to allude to cancerous disease of the ovary, and to say how difficult it is to decide whether an ovarian tumor is innocent or malignant, even after it has been removed and carefully examined. Now I can do no more than support the rule to operate early as the best way to avoid recurrence. I wished also to remind you how the mortality after amputation of the breast, and after removal of other parts affected by cancerous disease, has been so much lessened by modern sanitary science that all the old arguments against operating at all in cases of cancer require revision. I wished to say something about inadequate operations, and about operations which are unnecessarily severe—and much more than I did say against operating in hopeless cases, and in studying how to "soothe where we cannot save." Of cases which especially interest us, where cancer has affected the lips or tongue, the œsophagus, the larynx, the pylorus, the spleen or kidneys, the intestines, the bladder, and the female genital organs, I have not time to say another word. And now, in conclusion, I will only venture to express the belief that if some who have heard or who may read this lecture are convinced that cancer is increasing will try to find out the cause of the increase, and why cancerous diseases are so prevalent and so fatal; if they will also try to learn how to prevent or to cure them, no one can forecast the result. No one could have imagined that a forgotten book of Marco Polo would rouse the spirit of research in Columbus and lead to the discovery of a new continent, and no one can foretell what the work of one man may accomplish. It may be trifling, but—

> Think nought a trifle, though it small appear;
> Small sands the mountain, moments make the year,
> And trifles Life.

Each one may bring an offering, however small, to the altar of one of the temples of Æsculapius—or, if his own search for knowledge fail, he may assist in preventing the failure of others, and in guiding them along the path to full success. And, year after year, the Morton Lecture may exert some influence for good upon all mankind in all coming generations.

CARDIAC DYSPNŒA

AND CARDIAC ASTHMA

BY

PROF. DR. S. VON BASCH

CARDIAC DYSPNŒA AND CARDIAC ASTHMA.

I. Pathology of Cardiac Dyspnœa.

We apply the term dyspnœal to those forms of respiration in which increased exertion of the respiratory muscles is observed. This exertion occurs either in the work of the inspiratory muscles alone, or in that of the expiratory muscles, or in that of both. We distinguish, accordingly, inspiratory, expiratory, and general dyspnœa.

The impeded respiration may be present, although it is not brought to the notice of consciousness in an increased degree. This is called objective dyspnœa. But the impeded respiration may reach consciousness as a feeling of want of breath and in this event the dyspnœa is also subjective.

Dyspnœa may be the result of various causes.

If we disregard those causes which depend on diseases of the nervous respiratory centre and consider only those which affect the respiratory mechanism itself, we must first speak of the dyspnœa resulting from obstruction to the current of air in the upper air passages, the larynx and trachea, and in the larger and smaller bronchi.

Dyspnœa may also result from diminution of the respiratory surface proper of the lung, *i.e.*, the complex of the alveoli, by fluid due to inflammation, chronic and acute, or to catarrhal diseases of the mucous membrane. Distention of the lung may also be obstructed by compression from the outside, such as pleuritic exudation, the atmospheric pressure (pneumothorax) and tumors. Finally the diminished elasticity of the pulmonary alveoli, which renders impossible the return of

the pulmonary volume to the normal, may also lead to dyspnœa.

All these forms do not belong directly within the field of our inquiry. We will here discuss only that variety of dyspnœa in which the changes of the pulmonary mechanism, which have just been mentioned, are not the real causes, but the increased distention of the pulmonary vessels with blood is the immediate cause of the dyspnœa.

As it is the changed mechanism of the heart which leads to the increased fulness of the vessels, it seems to me to be expedient, and also justifiable from a clinical standpoint, to apply the term "cardiac dyspnœa" to this variety. That form of asthma which depends upon changes in the cardiac mechanism and which will be fully discussed later, is called cardiac asthma.

Much is said concerning cardiac dyspnœa, although not under this term, in the oldest and recent writings on diseases of the heart. It is unanimously described as the first and most important symptom of a developing disease of the heart, and there is hardly a disease, whether it affects the heart muscle itself, the pericardium. endocardium or valvular lesions associated therewith, in which it is not fully referred to as an accompanying symptom.

As regards the clinical interpretation of this symptom, we have hitherto been satisfied with the conception that the distention of the pulmonary vessels is a symptom of stasis. The relation of this stasis to the dyspnœa was sought in the slowing of the current of blood in the lungs, which interferes with the interchange of gases, in the diminution of space in the alveoli by the capillaries which are filled with blood and project into the alveolar space, and finally in the accumulation of secretion in the alveoli and bronchi, which was attributed to the stasis and known as stasis-catarrh.

A clinical picture that is not satisfied with describing a symptom, with pointing to the anatomical disturbances in the organs that are involved, but also attempts to afford an explanation of the biological processes that take part, may not be content with the general explanations and conceptions hitherto offered. It must embrace all the considerations that may serve to clear up and widen our views concerning the biological processes. It is in this way alone that the diagnosis

i.e., our recognition of a pathological condition, can correspond to the present status of medical science, which is built up by clinical, anatomical, and physiological experiences.

The clinical consideration of cardiac dyspnœa must start with physiological dyspnœa, *i.e.*, with the causes which produce dyspnœa in healthy individuals when they perform an unusual amount of work.

There is one physiological fact from which the discussion must start, and this fact, which I and others have determined by sphygmomanometric measurement, is the following: "the arterial pressure is increased by bodily exertion."

This increase occurs, as we may assume, in the following way:

The muscular work increases the amount of carbonic acid in the blood. Although the interchange of gases in the lungs is not changed by the muscular action, the blood thus acquires a dyspnœic character, therefore stimulates the vaso-motor centres, produces contractions in the vessels and thus leads to increase of the blood-pressure. As the respiratory centre also reacts, in the well-known manner, to the irritation of the dyspnœic blood, the respiratory movements become deeper and more rapid. This might secure a regulation, inasmuch as the deep and accelerated respiration might be able to remove the excess of carbonic acid produced by the muscular action, and to supply the greater amount of oxygen required.

But this regulation, as every one can experience by experimenting on himself, is insufficient, and the dyspnœa increases with continued forced movements, despite the respiratory strain.

Hitherto I had been unable to answer the question, why the dyspnœa continues, otherwise than with the assumption that the left heart exceeds the limits of its power of accommodation with the increasing resistance in the vessels, and that, when this happens, the left ventricle no longer empties its contents completely. Hence, the left auricle is more than usually filled with blood and, as a result, the blood is dammed back in the lungs.

But this view was opposed by the results of measurement of the blood-pressure. When I produced very marked dyspnœa in myself by rapidly climbing a mountain and made the measurements in the midst of the most marked dyspnœa, the

pressure of the blood was found to be very high, and by no means falling. This did not favor the opinion that my heart was unable to overcome the resistance of the vessels, since, if this were true, the blood-pressure would fall at the height of the dyspnœa.

My opinions, which accorded with the current conceptions of the relations of dyspnœa to blood stasis in the lungs, must therefore present an hiatus, and I was forced to the suspicion that the high blood-pressure *per se* and not the stasis in the lungs—which can only develop in a higher grade when the blood-pressure sinks—was a cause of the dyspnœa.

This suspicion was correct. Reflection, supported by undeniable facts, shows that the respiratory capacity of the lungs must suffer when, together with the increased pressure in the arteries, the pressure in the pulmonary artery also rises, as does actually happen.

In a recent article "Ueber eine Funktion des Capillardruckes in den Lungen" (Wiener med. Blätter, 1887, No. 15) I have shown that the walls of the pulmonary alveoli become more rigid when the capillaries imbedded in them are filled under high pressure, and that the respiratory capacity of the lungs is diminished by increase of this pressure.

In order to make this understood, I must here enter more fully into the subject.

Sufficient air ventilation in the lungs can be conceived only under the assumption that the volume of the alveoli is considerably increased during inspiration and correspondingly diminished during expiration. The bronchi and infundibula have little to do with the ventilation because they form cavities surrounded by comparatively rigid walls. As the result of this their lumen does not change materially, entirely apart from the fact that their structure is incapable of respiration. The greater the excursion of an alveolus and hence of the lung as a whole, the greater is the amount of moved air that is employed in ventilation of the blood. Whatever impedes these excursions must, as is easily seen, impair the respiratory power of the lungs.

Upon what does the amount of these excursions depend?

If we assume that the lungs are emptied of blood—this does not happen during life—then the diminution in the size of the alveolus would be the result of the elastic and tonic prop-

erties of the tissue elements in the alveolar walls; the enlargement of the alveolus would result from the traction of the inspiratory muscles, which oppose the elastic forces.

What happens when the pulmonary capillaries that surround the alveoli are filled with blood? Is the condition of the alveoli the same as when the lung is destitute of blood? By no means. In a measure, the filled capillaries cause erection of the alveolus; it becomes larger, its lumen increases, and its walls grow more rigid. The forces which are to dilate it during inspiration must therefore become greater and it cannot return to the same volume during expiration as a bloodless alveolus. The great difference between a lung whose vessels are empty and one whose vessels are filled, is shown by a simple experiment that I have recently performed.

The lungs with the heart are removed from the thorax of an animal, and the pulmonary artery together with the left auricle, into which the pulmonary veins empty, are provided with canulæ. At the same time fluid is forced into the lungs through the pulmonary artery from a vessel under pressure and the trachea is connected with a bellows that is regularly opened and closed. It will then be found that, when the bellows is set in motion, the lungs are distended to a certain extent with each descent of the bellows. If fluid is now allowed to enter the pulmonary vessels, it is first noticed that the lungs grow larger and, if the bellows are again used, the lungs will be distended less than before. If the trachea has been connected with a water manometer before this second distention and before the injection, we can also convince ourselves that the enlargement of the lungs after the injection does not depend upon the passage of fluid into the alveoli, inasmuch as the fluid sinks in the manometer, *i.e.*, the lungs exercise suction while enlarging, and this suction can only depend upon the fact that the space inclosed by the alveolar walls has become larger.

The fact that increased distention of the vessels causes erection of the tissues within which they are inclosed and makes them more rigid, is well known. Whoever has made or seen an artificial injection, could convince himself of this. But no one has thought heretofore of erection of the alveoli and its relations to respiration. It happened to me that I did not understand experiments (of which I will speak later) which

were made under my observation and direction and which, as I now see, clearly showed that the filling of the pulmonary capillaries under increased pressure interferes with the distention of the lungs. I was still imbued with the old idea that only the diminution in the size of the alveoli or their filling with fluid can interfere with the entrance of air into the lungs.

The alveolus or lung, whose vessels are filled with blood, acts accordingly in an entirely different manner from the lung which is empty of blood. It was not necessary for me to demonstrate this. The proof was found in the figures obtained from measurements made on the lungs of dead bodies by Donders and on the lung of the living animal by Jakobson and Adamkiewicz. These figures differ from one another in a notable degree.

The lung of the dead body exercises upon the closed thorax a traction which corresponds to the pressure of seven and one-half millimetres mercury. In the living animal this traction is much less, viz., three to five millimetres mercury. This shows clearly that the living lung, filled with blood, returns during expiration to a much less volume than the lung which is empty of blood.

The difference between the experiments of Donders and those of Jakobson and Adamkiewicz have not been interpreted hitherto in this manner. We have satisfied ourselves with the notion that the elasticity of the lungs in man is different from that in animals. It is unnecessary to enter into details in order to show that this notion is not correct.

The lung, whose capillaries are filled with blood, will therefore be larger in rest during expiration than the lung which is empty of blood or the lung of the dead body. As the elasticity[1] of the alveolar wall increases with the distention of the capillaries and consequently its distensibility diminishes, the forces which distend a lung filled with blood must be greater,

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[1] According to the doctrines of physics, a body is so much more elastic the greater the force or weight required to distend it to a certain extent. A rod of steel of a certain diameter is, in this sense, more elastic than a rubber cylinder of the same diameter. The distensibility of a body is, therefore, not in a direct but in an inverse proportion to its elasticity. The easily distended rubber cylinder is, in a physical sense, less elastic than the, with difficulty distensible, steel rod. As a matter of course, the rigidity of a body increases with its elasticity.

because the rigidity of the alveolar wall has increased with its elasticity.

Under normal circulatory conditions, in which the pulmonary capillaries are only exposed to a moderate pressure (concerning whose amount we possess no positive knowledge) the inspiratory muscular power is entirely sufficient, we must assume, to produce the distention necessary to sufficient ventilation.

It is clear that this force is required in an increased measure, when the pressure in the pulmonary artery increases and with it the pressure in the pulmonary capillaries. Such an increase may occur in two ways. The pressure in the pulmonary artery may increase with increasing pressure in the aorta or with diminishing pressure in that vessel.

In the consideration of physiological dyspnœa, the discussion of which we will now resume, a part is played only by the first factor, *i.e.*, the increase of the capillary pressure in the lungs, as the result of increased pressure in the arteries. How shall we conceive the mode of development of physiological dyspnœa? The starting point is the increase of arterial blood-pressure, as the result of narrowing of the vessels. If we enter more closely into the circulatory processes which attend the increase of arterial pressure—not on the basis of speculative consideration, as unfortunately happens very often, but on that of positive experimental experience—it will be found that this increase is almost always followed by a back action which causes an increase of pressure in the left auricle, in the pulmonary artery, and also in the veins. This is clearly evident from experiments in which the changes mentioned are observed after manipulations that increase the arterial pressure. I may refer to experiments that have been made in the Physiological Institute of Leipzig, by Waller under the direction of Ludwig, then by Openchowsky under Stricker's supervision. Lichtheim and I have made numerous experiments in this direction. Increase of pressure by irritation of the cervical cord distends the left auricle with blood to such an extent that its movements cease. As the result of dyspnœal irritation of the vessels in suffocation, the pressure of the pulmonary artery increases with that of the aorta, and, as I know, the pulmonary pressure also increases when the increased aortic pressure has been produced in a reflex manner. It has

also been known to me for three years, from experiments made by Dr. Schweinburg under my direction, that the increased aortic pressure resulting from strychnine is followed by a very considerable increase of the venous pressure. In the increase of pressure in the aorta which is caused chiefly by narrowing of the small arteries, the two halves of the heart, the tract of the lesser circulation situated between them, and the vessels of the greater circulation are more filled with blood than the small arteries and capillaries of those tracts that are affected by spasm. In this changed condition of the pressure and distribution of the blood, the lungs, as is readily seen, are most affected because every increase of pressure in their vessels means an increase in rigidity of the alveoli, and thus an impairment of the respiratory functions. The development of dyspnœa in increase of arterial pressure is now explained very easily. If dyspnœa does not occur on forced muscular movement, the reason may be seen in the following considerations. In the first place, it is possible that the rigid alveoli are sufficiently distended by greater traction of the respiratory muscles during inspiration, and that, as this corresponds to the greater amount of blood which flows through the lungs in a more rapid current, a greater movement of air in the lungs takes place by means of which the poverty of oxygen and the increase of carbonic acid in the lungs are prevented. This at least explains the fact that forced muscular movements which increase the blood-pressure do not produce the feeling of dyspnœa. Furthermore, as is self-evident, the muscular movement will not produce dyspnœa when it does not give rise to increased pressure in the arteries, or when such increase is very slight. Numerous experiments in this direction are wanting, but we will hardly go astray in concluding from the experiments hitherto made that habit here plays a great part; at least the well-known fact that even skilled mountain climbers, after they have rested for a long time, must, so to speak, train for long trips by smaller ones, is explained easily by the assumption that the irritability of the vaso-motor centres to the stimulus produced by muscular movement is diminished after prolonged action. In this sense I would interpret the statement of Oertel who by means of my sphygmomanometer demonstrated upon his patient, Dr. N., a greater increase of pressure after the first mountain climb than after subsequent

ones. In the same sense I would also interpret the experiments made by Marey upon horses. He found that the blood-pressure not alone does not rise during work, but even sinks. He is inclined to generalize this result, and extend it to men, but in my opinion without justification. The horse is a beast of burden, and is by no means to be compared with man. When the latter is unused to work, he is especially apt to suffer from palpitation of the heart, and from shortness of breath on increased effort. Yet we should examine whether working-people do not act like the horse so far as regards their blood-pressure. It is shown, however, by the reports of autopsies upon racing horses and hunted deer, in whom colossal hypertrophy of the heart was found, that even in these animals a great increase of blood-pressure must occur as the result of excessive strain.

Dyspnœa after bodily exertion is a cardiac dyspnœa. So long as its development can be attributed to unusually great stimuli, it is to be regarded as physiological. The term pathological cardiac dyspnœa may only be used when slight causes suffice to produce it. If we hold fast to the view that the swelling of the lungs and their rigidity constitute the primary factor, the relative insufficiency of the muscular respiratory apparatus, the secondary factor, which produce cardiac dyspnœa when acting together, we can readily understand that in the different cases a greater etiological importance attaches sometimes to one, sometimes to the other factor. We have learned that excessive bodily movement, which under certain circumstances increases the blood-pressure in a high degree, is the cause of physiological cardiac dyspnœa. We must now concern ourselves with those causes which also give rise to increased blood-pressure, and come into play in pathological cardiac dyspnœa. Bodily movement, but not excessive, is among the first of these causes. We must consider not alone the character of each movement, but also the work produced. A strong bodily movement in a muscular, but lean individual by no means indicates the same effect as a comparatively slight effort in individuals whose muscles are weak, but who possess a large deposit of adipose. This difference will be especially felt in lifting the entire weight of the body, for example, in ascending a mountain. If a lean individual gets out of breath in walking up a flight of stairs, we must infer a greater

disturbance of the circulatory apparatus than when this happens under similar circumstances in a very stout individual. The increased work of the heart in such cases is often associated with the feeling of palpitation of the heart, but palpitation is by no means a constant symptom in dyspnœa resulting from movement. Increase of blood-pressure also occurs in changes of the position of the body. In standing the blood-pressure is less than in the recumbent position, as various experiments have proven. The increase of blood-pressure on lying down may therefore be a cause of the development of cardiac dyspnœa, and this corresponds perfectly to clinical experience. The dyspnœa which develops on lying down is usually, though not always, associated with the feeling of palpitation of the heart. Mental excitement, cutaneous reflexes as the result of thermal actions, such as baths, douches, etc., may also cause increase of the blood-pressure This increase is often preceded by palpitation. Dyspnœa very often occurs with the palpitation, and is probably connected with the increase of blood-pressure. Palpitation and dyspnœa may also result from toxic action, such as that of coffee, tobacco, etc. We must now ask how it happens that slight increase of pressure in the arteries is followed by a comparatively great increase in the pulmonary and the capillaries of the alveoli, and thus impairs the respiratory capacity of the lungs to a considerable extent. As I have become convinced from protracted observation, sphygmomanometric measurements are of special value in the consideration of the condition of the patient. If these measurements show normal pressure, and if examination also shows that the frequency of the pulse is normal, and that the size, beat and sounds of the heart present no abnormal condition, and if we also find—assuming that the lungs themselves furnish no cause for respiratory disturbance—that the tendency to dyspnœa is nevertheless present, this can only reside in two causes. In the first place, there may be abnormal irritability of the vascular system which causes very great increase of blood-pressure after slight causes. If this is not the case, as must appear from the examination, the cause can reside only in an insufficiency of the heart, which may occur despite apparently normal findings. In absolute or relative rest of the body, this insufficiency is not manifested. Its effect is shown at once when the heart is required to perform increased labor.

If for any reason there is a slight increase of resistance in the arteries, and therefore a slight increase of blood-pressure in the pulmonary, then, if the left heart is able to do the increased work, *i.e.*, to empty itself completely—assuming that the regulating activity of the respiratory muscles is entirely intact—there is no occasion for the occurrence of dyspnœa. But such an occasion arises at once, if the pressure in the pulmonary artery or capillaries increases to a comparatively greater extent than that in the arteries. This must occur at once when the left ventricle becomes insufficient, *i.e.*, when it evacuates its contents incompletely. If this happens, then the pressure in the left auricle, whose contents cannot be evacuated completely into the left ventricle, must increase, inasmuch as the ventricle is fuller than normal at the close of systole and the beginning diastole. As a result, the pressure in the pulmonary artery and capillaries must increase. I need no longer enforce the fact that this increase entails greater swelling of the lungs and greater rigidity.

Measurements may also show a sub-normal pressure in the arteries. In such cases we must first consider whether the low blood-pressure is associated with normal or abnormal distribution of the blood. If the distribution is normal, *i.e.*, if the low pressure depends upon the slight resistance in the arterial tracts, and the cause for the slowed current of blood must be sought outside of the heart, then the same considerations hold good as before with regard to the development of dyspnœa. From the height of the blood-pressure alone we cannot infer directly that the action of the heart is insufficient, inasmuch as many cases are observed in which there is no disposition to dyspnœa, despite low blood-pressure, *i.e.*, in which a heart that normally does little work suffices entirely for increased work. If dyspnœa occurs in such cases in which the blood-pressure is lowered, then we have to deal either with abnormal irritability of the vascular system, or relative insufficiency of the left ventricle. It is different when the low pressure develops in combination with a changed distribution of the blood, *i.e.*, when the arteries are less distended because the veins and the lesser circulation contain comparatively more blood. Whether this is true must be determined from the condition of the veins of the neck, and of the other veins, especially in the lower extremities, in which varices or even

slight œdematous swellings occur, but particularly from the condition of the heart itself. Intensification of the second pulmonary sound, a difference in the intensity of the sounds of the left and right heart, enlargement of the heart toward the sternum also favor the view that the low arterial pressure depends upon weakness of the heart. One of the most important data consists in the very great predisposition to shortness of breath. This is very easily explained. With the changed distribution of the blood the pressure in the pulmonary artery and capillaries increases. The lungs of individuals with weak hearts must therefore be larger and more rigid from the start, and the limit at which the rigidity reaches a stage when the work of the respiratory muscles is no longer sufficient will very soon be passed. This no longer requires, as in the former cases, increased stimuli or increased blood-pressure in the arteries, because, inasmuch as the heart is insufficient from the start, the slightest increased work of the left ventricle must be remarkably noticeable in the pulmonary circulation. In addition, there is the important fact that the transition from a high grade of pulmonary rigidity or elasticity to a still higher one takes place, not in arithmetical, but in geometrical progression, *i.e.*, that the distensibility of the lungs diminishes in a still more marked degree in the higher grades of distention with blood. The same remarks hold good with regard to those cases in which the changed distribution of the blood is produced by valvular lesions in which a lower blood-pressure is found. It is evident that a valvular lesion, so far as regards its general effect upon the distribution of blood, is equivalent to insufficiency of the heart because in certain of these cases the left ventricle at systole throws into the arteries only a part of the blood which has collected in the left auricle during its diastole.

In excessive arterial pressure, predisposition to dyspnœa will always be considerable because the high arterial pressure is accompanied by high pressure in the pulmonary artery, and therefore by increased rigidity of the lungs. This corresponds to the clinical experience that a very great tendency to cardiac dyspnœa is shown by individuals in whom high arterial tension is observed, whether as the result of arterio-sclerosis or of chronic nephritis or retraction of the kidneys, or of both together. Here, as in all cases in which the pulmonary ves-

sels are filled under higher pressure, the volume of the lungs will be comparatively greater on account of the condition of swelling of the organ.

The predisposition to dyspnœa increases still more when the pressure in the pulmonary artery and left auricle is greatly increased. This may happen when, as the result of very great frictional resistance in the arteries in severe arterio-sclerosis, the current of blood in the arteries and capillaries is very slow, and hence the veins and lesser circulation are filled under relatively higher pressure. Such a condition would be shown by pronounced swelling and pulsation of the cervical veins.

Finally, relative increase of the pressure in the pulmonary artery may also result from insufficiency of the heart muscle. In this event, increased fulness and pulsation of the veins of the neck will again be one of the characteristic symptoms. Hypertrophy of the heart, even when it has reached a high degree, does not exclude the possibility of such insufficiency, because a strong predisposition to dyspnœa and pronounced venous pulsation are observed particularly in cases of hypertrophy of the left heart.

In addition to the condition of the lungs which develops as the result of the circulatory disturbance just mentioned, we must also consider the condition of the respiratory mechanism situated outside of the lungs. Its unimpaired functions may in some degree compensate for the obstruction to respiration due to the lungs themselves. Pari passu with diminished distensibility of the lung, the inspiratory muscles may vigorously dilate the space within which the lungs are inclosed to a greater extent; furthermore, the expiratory muscles which, as a rule, are at rest during normal respiration because expiration is effected solely by the elastic force of the thorax and lungs, now also come into action and aid in diminishing the size of the lungs.

Wherever the conditions for the production of this compensation are absent, cardiac dyspnœa must develop more easily under otherwise similar circulatory conditions.

In the first place, respiration may be relatively insufficient on account of weakness of the respiratory muscles. This may occur in emaciated individuals and those reduced by severe disease. In general lipomatosis, it may also happen that the diaphragm and intercostal muscles undergo fatty degenera-

tion, like the other muscles of the body. To Germain Sée belongs the credit of having called attention to this important point. In pseudo-hypertrophy of the muscles, it is also possible that the degeneration may produce respiratory insufficiency. The activity of the respiratory muscles may also be interfered with by obstacles to the distention of the thorax. This is the case in horizontal decubitus, in which the thorax rests upon a firm base, and the excursions of the ribs are impeded by friction. The obstacles to the distention of the thorax may also result from the elevation of the diaphragm, as the result of abnormal fulness of the abdominal cavity (distention of the intestines by gas and fluid accumulation in the abdomen, tumors, etc.). Finally the excursions of the thorax may be hindered by deformity resulting from curvature of the spine, rachitic changes in the ribs, adhesions after exudations, etc. I disregard entirely those processes which involve the lungs themselves, because they are no longer instances of pure cardiac dyspnœa.

II. Pathology of Cardiac Asthma.

The asthmatic attack is distinguished from dyspnœa by its sudden, but, above all, by its spontaneous occurrence. In cardiac dyspnœa the external causes are known in every case while the cardiac asthmatic attack develops apparently without any visible cause. I say apparently, because such causes surely exist, as is shown by reflection and observation.

In what do the causes of this sudden occurrence of cardiac asthma consist?

We must first distinguish between the attacks that appear during the day and those that appear at night. The nocturnal attacks may again be differentiated. The attack may occur as soon as the patient lies down, *i.e.*, before he falls asleep or shortly after falling asleep, *i.e.*, in the first slumber, before sleep is profound, or finally in the middle of the night during deep sleep.

We will start with the last case and discuss the causes of an attack of cardiac asthma occurring in deep sleep; we will then consider the processes present at this time in the circulation, *i.e.*, in the heart, vessels, and lungs.

Traube properly called attention to the fact that the super-

ficial character of respiration during sleep is the chief cause of the development of the asthmatic attack. In addition we must take into consideration the fact discovered by Burdon-Sanderson that the rima glottidis is narrowed during sleep on account of relaxation of the laryngeal muscles.

How do these two factors aid in the production of the seizure?

When respiration is superficial and the rima glottidis narrow, the respiratory process, *i.e.*, the interchange of gases in the blood, will be less active than in the waking condition. It is sufficient, as a rule, because the need of oyxgen is much less in complete rest of the body, and the excretion of carbonic acid is not so abundant. But the degree of fulness of the pulmonary vessels must play a part during sleep as well as in the waking condition. If the pulmonary vessels are relatively less full during sleep, the superficial respiration will more readily suffice for the respiratory needs than when the pulmonary vessels are fuller.

Our knowledge of the condition of the blood-pressure during sleep is very slight. From experiments which I made some years ago with the pletismographic method, I learned that the volume of the arm diminished during sleep. I attributed this to lowering of the blood-pressure. My experiments were made during the day upon patients in a surgical ward.

On the other hand, Mosso has observed increased volume of the arm during nocturnal sleep. So far as I can judge of the changes in volume, this would testify in favor of an increase of the blood-pressure. Unfortunately I have had no opportunity of making such observations with the sphygmomanometer.

If we take into consideration that the blood-pressure is greater, in general, in the recumbent position, it cannot be denied that an increase of pressure may occur during sleep. If this happened, the superficial respiration, which occurs as the result of sleep, would become relatively insufficient, *i.e.*, it would not suffice for the increased rigidity of the lungs and would lead to dyspnœa. It is also conceivable that the respiration is more than usually superficial in certain cases and that this would lead to dyspnœa without the aid of increased pressure.

The dyspnœa which has thus developed, whether in one

way or the other, would give rise to increase of the blood pressure. In the first event, the already higher pressure will become still higher, and in the second event, the normal blood-pressure will be increased.

As I conceive, these are the prodromes which may be followed by the asthmatic attack.

In this preliminary stage, which may develop without reaching the patient's consciousness, the processes are identical with those during cardiac dyspnœa. In both cases the increased blood-pressure in the arteries causes rigidity and swelling of the lungs, but in the former the increased pressure occurs during bodily rest, in the latter it is produced during bodily movement.

It is easily understood that the unfavorable effect of the swelling of the lungs upon respiration is much more marked during sleep than during the waking condition. In sleep, the insufficiency of the respiratory mechanism is a normal phenomenon, and on account of this insufficiency the compensation on the part of the respiratory mechanism remains absent in part. I say in part, because the possibility is not excluded that dyspnœal intensified respiratory movements may occur during sleep. In the waking condition, however, the compensation will always be more complete because the freer position of the thorax favors its distention and because the automatic impulses, which start from the medulla oblongata, are reinforced by voluntary impulses which, as we may assume, increase the work of the respiratory muscles.

Traube had called special attention to the importance of the will in respiration. He properly maintains that orthopnœa, *i.e.*, the condition in which the patient voluntarily attempts to increase the effect of respiration by a more favorable position of the body, constitutes a much more favorable condition of respiration than that in which the already somnolent patient is no longer able to sit up and does not feel the shortness of breath, although this is very intense, as shown by the cyanosis. What Traube says of somnolence is also true, in a measure, of sleep.

These considerations also favor the assumption that dyspnœa and its results (increase of blood-pressure and pulmonary rigidity) can develop much more suddenly during sleep than in the waking condition, and easily explain the fact that the

patients are not roused from sleep until the dyspnœa has reached a very high grade.

So long as the sudden dyspnœa continues under high blood-pressure, so long, in my opinion, it should be regarded as the prodromal stage of asthma. The term asthma should only be applied to that condition in which the heart has changed its condition of equilibrium and in which the distention of the pulmonary vessels no longer depends upon increased pressure in the arteries, but is associated with considerable diminution of pressure. Here again Traube first recognized the truth and made the very apt remark that, in the development of the asthmatic attack, we have to deal with a labile condition of the heart.

In what manner can the heart fall from its condition of equilibrium?

We will discuss this question upon the basis of our physiological knowledge and the results furnished by clinical examination.

The experimental material at our command is tolerably assured, but the clinical material has been insufficiently utilized in this direction, because the conceptions which should guide clinical observation have been wanting hitherto. For this reason I speak only of an attempt to explain the production of cardiac asthma. An explanation, which is also satisfactory from a clinical standpoint, can only be given when it turns out that the results of clinical observation and post-mortem examination are in thorough harmony with those of experiments.

As the latter show, the change in the condition of equilibrium of the heart may occur in two forms, as paresis or paralysis of the heart, and as spasm of the heart.

The former can be studied experimentally in suffocation, the latter in muscarin poisoning. Both forms furnish the basis for the notions that guide us in comprehending the processes that occur in cardiac asthma.

If artificial respiration is interrupted in a curarized animal whose respiration is maintained artificially by blowing air into the lungs, the animal is left to the action of the blood of suffocation, and we can examine the processes in the right and left halves of the circulation, as Openchowsky showed and as I have often seen and demonstrated. With the increase of

pressure in the aorta during suffocation—a long known fact—the pressure in the pulmonary artery (which had fallen temporarily at the beginning of suffocation) also rises. In the further course of the suffocation, at a time when the pressure in the artery is falling to a marked extent, the pressure in the pulmonary artery again increases, to an even greater extent than at the beginning.

Observation of the exposed heart, in addition to measurement of the pressure in the aorta, pulmonary artery and the auricles, sufficiently explains what takes place in the heart and circulation during suffocation. At first, when the pressure in the aorta and pulmonary artery is high, the heart appears uniformly distended in both halves. Both ventricles pulsate vigorously and sufficiently, but soon the left ventricle and auricle (the latter to a less extent) begin to dilate, while the right ventricle, on the other hand, grows smaller. The contractions of the left ventricle diminish somewhat in vigor with its dilatation, and at this time it is found that the pressure in the carotids is diminishing. The contractions of the right ventricle have apparently lost none of their vigor at this time. It is only at a very late period, when only slight contractions, which run across the surface like waves, are visible upon the surface of the left ventricle, that the contractions of the right ventricle also grow more feeble.

This condition of the heart is the result of paresis, due, in its turn, to the blood of suffocation. In such a case we cannot speak of paralysis because, on resuming artificial respiration, the heart soon returns to the shape and mode of action which it had shortly after suffocation. The heart can only be regarded as paralyzed in such experiments when it can no longer be restored by artificial respiration, *i.e.*, by supplying oxygenated blood. In a paralyzed heart, the wave-like contractions of the left heart and the feeble contractions of the right heart grow constantly smaller and finally cease, despite artificial respiration.

Why does the left ventricle alone dilate after the injurious action of the toxic dyspnœal blood? Undoubtedly because the two halves of the heart do not react in the same way to the toxic blood.

As a result of the weaker action of the left ventricle, not alone does it no longer throw its contents completely into the

arteries, but a part remains in the ventricle at the close of systole. Hence the diastolic distention of the left ventricle gradually increases and, at the same time, the right ventricle, which receives its blood indirectly from the arteries, is filled less and less. The action of the right ventricle long suffices to expel the constantly diminishing amount of blood which it receives from the left heart and hence the left heart continues to be filled by the right heart.

On account of this increase of pressure in the left auricle, —which results from two factors, the uninterrupted supply from the lungs and the obstructed passage into the left ventricle, which is becoming more and more filled and can no longer empty itself on account of the weakness of its muscular tissue—the pressure in the pulmonary vein increases at a time when that in the arteries is diminishing considerably.

As the pressure in the pulmonary vein and left auricle increases with the increasing paresis of the heart, the pressure in the pulmonary capillaries must also be very high and hence a high degree of swelling and rigidity of the lungs may develop.[1]

Like the cessation of artificial respiration in the curarized animal, so the dyspnœa of the prodromal stage of asthma in man may change the blood in such a way that it produces paresis, and the heart may thus fall into the condition which we have just described.

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[1] I have spoken of unlike reaction of both halves of the heart to the blood of suffocation. This unlikeness may be only apparent. It is possible that the left ventricle becomes larger because its power diminishes under distention of its walls. This distention would result from the resistance which the dyspnœally contracted vessels offer to the evacuation of the left ventricle. This resistance is present at a time when the arterial pressure is diminishing on account of the paresis of the heart, and when the paresis itself creates new conditions which also lead to increased filling of the left ventricle. The primary dilatation of the right ventricle at the beginning of suffocation is in great part the result of its increased fulness, and may disappear when the latter diminishes. This would explain the apparently dissimilar heart's action and the unequal size of both ventricles. On the other hand, it must be remembered that the left ventricle, as a rule, contains no dyspnœal blood, while this always forms the contents of the right ventricle. Upon this fact may also depend the greater sensibility of the left ventricle to dyspnœal blood.

The second form of disturbed equilibrium of the heart (spasm) is explained by the study of the processes observed in the heart and lungs of mammals after the introduction of muscarin. These experiments have been made by Dr. Grossmann in my laboratory and will be described exhaustively in the twelfth volume of the "Zeitschrift für Klinische Medicin." I will here refer only to what is absolutely indispensable in order to comprehend the subject.

If a solution of muscarin (one-half per cent) is injected into a curarized animal, whose respiration is maintained artificially, it will be found that the pressure in the arteries sinks but, at the same time, the pressure in both auricles and in the pulmonary artery increases. The increase of pressure in the left auricle is much greater than that occurring in Openchowsky's above-mentioned experiment. As the pressure phenomena are essentially the same as those observed in paresis of the heart from suffocation, it might be expected that muscarin paralyzes the heart. This is not so. The condition of the heart after the administration of muscarin is entirely different from that observed in an animal during suffocation.

When the exposed heart of an animal poisoned by muscarin is watched, it is found that the right ventricle, not the left, undergoes dilatation. The left ventricle appears small and contracted, and only the right heart and the two auricles, particularly the left, are distended with blood. The heart is in a spastic, not in a paretic condition. This spastic condition is more marked in the left ventricle than the right because the muscular tissue of the former is much more strongly developed than that of the latter. The muscular spasm diminishes the lumen of the left ventricle; hence during diastole, which is incomplete, the left ventricle cannot receive all the blood which flows from the distended left auricle and, although its systolic power is unchanged, it cannot fill the arteries sufficiently and produce high tension.

The right heart, as shown by its dilatation and the high pressure in the right auricle, still receives an abundant supply of blood and throws it into the lungs as shown by its vigorous contractions and the high pressure in the pulmonary artery. In the pulmonary vessels and capillaries, the blood is under very high pressure because its escape into the distended left auricle is interfered with. The pressure in the pulmonary

capillaries attains such a height that transudation of fluid into the alveoli (œdema of the lungs) may result.

I cannot enter here into the proofs that the condition of the heart and the circulatory disturbances after the administration of muscarin really depend upon cardiac spasm, and must refer to Dr. Grossmann's treatise. We must emphasize the fact that the changes in the condition of the lungs in spasm of the heart are more profound than in paresis of the organ. This is evident indirectly from the condition of the blood-pressure in the lesser circulation. It can also be observed directly that the degree of pulmonary rigidity is much greater than that occurring as the result of suffocation and consequent paresis of the heart. The lungs of an animal poisoned with muscarin become so rigid that the air introduced is hardly able to distend them. But if the lung of an animal is tested, during suffocation, as regards distensibility (as I have seen in an experiment made by Schweinburg), it is found to suffer much less than in an animal poisoned with muscarin; in other words, the changes in volume of a lung filled with blood as the result of paresis of the heart differ to a less degree from the normal. This is in entire accord with the hydrodynamic conditions found on experiment; these show that, after paresis of the heart, the pulmonary capillaries are filled under less pressure than they are after spasm of the heart.

The difference between the two conditions as regards the distribution of the blood may be summed up as follows. In the paralytic condition of the heart, the blood in the greater circulation which has been thrown out of circulation is found in part in the lungs, in greater part in the left heart; in spasm of the heart, this blood is found in part in the right heart, in greater part in the lungs.

Of these two forms under which, as experiments show, the heart may change its condition of equilibrium, it may be assumed with certainty that the former possesses actual clinical significance. This view is favored by the fact that the dyspnœa produced by asthma has the same injurious action as suffocation has in experiments. The diminished respiratory capacity of the lungs is equivalent, under certain circumstances, to the cessation of artificial respiration.

Autopsical examinations also show, as I have learned from

authoritative sources (Kundrat, Ed. v. Hoffmann) that the left ventricle is found distended much more often than the right.

We must also ask whether the theory of cardiac spasm has any clinical justification. In other words, may the results of the experiments on animals be transferred to man and may it be assumed that there are forms of asthma which are attended with the development of spasm of the heart?

This was justifiable as regards paresis of the heart because we were warranted in inferring the same causes from the same effects—from the blood of suffocation as a cause, to paresis of the heart as an effect. Whether the blood of suffocation cannot act upon the heart in two ways, causing paralysis at one time and spasm at another, cannot be answered at present by experiment, and it must therefore be left in doubt whether dyspnœa as such may give rise to spasm of the heart.

But if we disregard cardiac spasm as the immediate cause of that condition in which the equilibrium of the heart is changed in such a way that the right and not the left ventricle undergoes dilatation, and if we look for another explanation of such a condition, we will easily find it if we assume that paresis of the heart may occur without dilatation of the left ventricle. The same cause, *i.e.*, dyspnœa, would then produce the same effects, viz., paresis of the heart. But this, according to our assumption, would vary in different cases. In one, which has been proven by experiment, the left ventricle would relax and dilate with the diminution in its contractile power, in the second supposed case its contractile power alone would diminish, but it would lose the power of dilatation; a sort of retraction might occur, independent of spasm. If this power of dilatation is lost, then the shape assumed by the heart must resemble that produced by spasm of the heart, *i.e.*, the right ventricle and left auricle must dilate (cardiac retraction is a phenomenon well known to experimenters and often seen in the frog. My assumption thus seems to be favored by the analogy).

The view that there may be a form of cardiac paresis whose results are analogous to those of cardiac spasm, does not disprove the opinion that spasm of the heart may also occur.

For the reasons just mentioned, the assumption of a cardiac spasm cannot be brought directly into association with dysp-

nœa, but with other causes which may give rise to a change in the condition of the heart. We must first think of causes of nervous origin.

It seems to me important, in this connection, to mention that angina pectoris, a disease attributed generally to a nervous origin, is regarded by many as a spasm of the heart. Heberden originally assumed a cardiac spasm in angina pectoris, and Dusch has adopted this theory. v. Bamberger also speaks of hyperkinesis of the heart in angina pectoris.

As I will show in detail in a paper on angina pectoris, those cases in which dyspnœal or asthmatic symptoms do not occur during the attack or are hardly noticeable, cannot be due to the same condition of the heart or lungs as in asthma. It is very possible, however, that in those cases of angina in which cardiac asthma plays a principal part, the latter may be due to spasm of the heart, like the pulmonary rigidity in muscarin poisoning. It is also possible that asthmatic attacks in which reflex irritation from the stomach, intestines, etc., is the primary or exciting factor, are the result of spasm of the heart. (The view that cardiac spasm is associated with nervous influences, is made very probable by experiments. The spasmodic condition of the heart in muscarin poisoning may be relieved, as Grossmann's experiments show, by irritation of the accelerator nerve. This favors the notion that muscarin produces the nervous spasm through the medium of nervous influences.)

To sum up in a few words, cardiac dyspnœa may place the heart in a paretic condition and thus produce cardiac asthma; furthermore, a primary spasm of the heart may develop and give rise to asthma. The first form must be called paralytic asthma, the second spasmodic asthma.

The assumption that the heart may pass into a condition like that described as spasm is also supported, so far as my knowledge goes, by post-mortem findings. After sudden death it is found not infrequently that the right heart, not the left heart, is enlarged considerably in its dimensions. As a matter of course, such findings do not teach us whether the left heart was undilated because it was attacked by spasm during life or because its muscular tissue was in a condition of retraction after paresis which did not permit dilatation of the left ventricle. At all events, according to these post-mortem

appearances, spasm or retraction of the heart may be included among the possible conditions.

From the views here developed, it is self-evident that the condition of fulness of the heart, especially the left ventricle, plays a great part in the development of cardiac asthma. In a heart, whose left ventricle is very full and normally expels its blood under great resistance, the limits at which the heart can still respond to the increased demands will soon be reached as the result of further increase of the resistance. Paresis as well as spasm or retraction would here have a greater effect, because it would transfer a large amount of blood from the left into the right circulation. This agrees with clinical experience in so far as cardiac asthma occurs with special frequency under high arterial pressure, *i.e.*, in arterio-sclerosis and those valvular lesions which result from arterio-sclerosis such as aortic insufficiency and stenosis.

In addition to the high intercardial pressure, whose increase is apt to induce sudden over-distention of the heart and may lead temporarily to a condition like paralysis, it is to be remembered that, in arterio-sclerosis, the sclerotic process in the vessels, especially when it attacks the nutrient vessels of the heart, is apt to give rise to nutritive disturbances and pathological tissue changes in the heart and thus diminish its power of resistance.

In fact cardiac asthma, as Leyden has recently shown, is a very frequent symptom in sclerosis of the coronary arteries. In my opinion, however, cardiac asthma has nothing to do with sudden occlusion of the coronary artery. This leads to sudden paralysis, followed by death if permanent, by syncope if temporary, but in no event does dyspnœa or asthma follow sudden general cessation of the action of the heart.

In my remarks I have referred to those asthmatic attacks which appear during sound sleep. Asthma may also occur during the first sleep, and its causes are probably the same as in the former event. The stage of latency, however, is much shorter. Latency may be entirely wanting in those cases in which the asthma occurs during the day.

The exciting causes of diurnal asthma, as opposed to the nocturnal form, includes changed position of the body (recumbent position), bodily strain, mental and sexual excitement. I have seen cases in practice in which cardiac asthma occurred

for the first time immediately after coitus. Further causal factors are distention of the stomach and intestines, and toxic influences. The latter include, in the first rank, those resulting from uræmia. It is also said that nicotine poisoning may give rise to cardiac asthma. I have seen no cases of this kind, although a number of instances have come under my observation in which nicotine poisoning produced cardiac symptoms (arhythmia, palpitation), and this cause undoubtedly takes part not infrequently in the production of angina pectoris. In severe cases of angina pectoris attended with cardiac asthma, when due to nicotine poisoning, the nicotine may be the indirect cause of the asthma. Chloral may also produce an attack of cardiac asthma, as I once observed.

The period of latency, *i.e.*, the development of the asthma, which attains its greatest intensity under falling blood-pressure, *i.e.*, under disturbance of the equilibrium of the heart's action, is not wanting here, but develops with the perfect consciousness of the patient. The course of the phenomena is probably the same as in nocturnal asthma, *i.e.*, the attack begins with high blood-pressure and consequent swelling of the lungs; it may remain at this stage or pass into a second stage characterized by low blood-pressure as the result of paresis, spasm, or retraction of the heart.

During the attack, the lungs may exhibit only swelling and rigidity or, as in muscarin poisoning, more or less extensive œdema may set in. Experiments lead us to infer that œdema of the lungs will develop in those cases in which the paresis of the heart occurs in that form which is analogous to spasm, *i.e.*, in the form of retraction. As is shown by the muscarin experiment, the conditions which give rise to œdema of the lungs, *i.e.*, the coincident increase of pressure in the pulmonary artery and left auricle, develop to the high degree which leads to œdema only when spasm of the heart occurs. In the cardiac spasm following the administration of muscarin, œdema of the lungs occurs; in suffocation paralysis of the heart, the lungs become swollen and rigid, but not œdematous. (The Cohnheim-Welch theory of pulmonary œdema cannot be maintained in its full sense. Œdema of the lungs cannot occur in early paralysis of the left ventricle, provided that the paralysis is complete and has led to dilatation of the left ventricle.)

III. Symptoms of Cardiac Dyspnœa.

The main symptom is the feeling of want of air, which is present in greater or less severity. In the latter event, the patients are not thoroughly conscious of their condition. In describing their condition, they mention everything but the difficult breathing, and their attention is only called to it by direct questions.

As a rule, complaints concerning respiratory disturbances are heard only in more advanced cases, particularly when the want of breath is felt not alone after bodily strain—in this event it is not regarded by the patient as abnormal—but also when it appears to develop spontaneously. This happens generally after eating, especially after a hearty meal, when the difficulty of inspiring sufficient air is experienced during the ordinary, moderate movements. Patients who suffer from constipation state that walking is much more difficult on days when the bowels are not evacuated than on those in which a passage has been secured. Complaints concerning dyspnœa are also made when it attacks the patients after excitement, and they sometimes tell us that temporary annoying shortness of breath becomes noticeable after sexual excitement and coitus.

Respiratory disturbances appear very often in individuals in whom a rapid accumulation of fat, especially on the abdomen, has developed. I attach special importance to the latter circumstance, for in my experience, which has been very large in this direction, it is by no means true that individuals, who take on fat over the entire body, begin to suffer at once from shortness of breath.

Obesity may exist for years, it may even develop in individuals who are by no means sedentary in their habits and in whom, accordingly, external causes for the development of dyspnœa are not wanting (as in ardent hunters, workmen) without the occurrence of shortness of breath as a striking symptom. It is often not until the lapse of years that the obese individual complains of short breath, often at a time when the weight of the body is decreasing.

The manner in which the want of breath is perceived differs in different individuals. They sometimes complain of deficiency of air, hunger for air, sometimes that breathing is difficult. In the former event the respiratory activity does

not appear to be obstructed, but the activity is ineffective and unsatisfactory, and is felt as such. In the second case the insufficiency of respiration, if I may so express myself, is felt directly. The patient says "breathing becomes difficult." In the first case, the patient feels as if he were performing a labor of Sisyphus; in the second case, he experiences the labored character of the increased work of the respiratory muscles. The feeling of want of breath is associated not infrequently with a feeling of oppression, constriction or pressure, but this does not always happen.

Palpitation of the heart is one of the associated symptoms of dyspnœa, but is by no means constant. There may even be very severe dyspnœa without a trace of palpitation. Others are observed in which a very slight degree of dyspnœa is accompanied by palpitation. When the latter symptom is present, it does not always begin with the dyspnœa. Sometimes the palpitation begins much earlier than the dypsnœa. At other times both appear at the same time, and finally the palpitation may not begin until long after the dyspnœa has developed. When the palpitation occurs with or during the dyspnœa, it must be assumed that both symptoms are related and they are to be regarded as the effect of the same cause, viz., the increased pressure in the arteries or pulmonary artery. I base this opinion upon the fact, repeatedly observed by me, that the blood-pressure increases during the palpitation, sometimes to a very considerable extent (thirty to fifty millimetres). When the dyspnœa does not appear until the palpitation has lasted a long time or is subsiding, we must be cautious in forming an opinion with regard to the respiratory condition. A year ago I had under observation a girl who suffered from palpitation of the heart and also complained of dyspnœa. Careful examination showed that this was not true dyspnœa. After the palpitation had lasted some time, the girl ceased to respire more deeply, indeed the respiration stopped entirely for a short time. This was not dyspnœa but apnœa, *i.e.*, a condition of absence of the desire for air. It resulted from the acceleration which the current of blood probably experienced during the palpitation and which caused overventilation of the blood in the lungs. The interpretation of this case depends upon an experiment made by Sigmund Mayer. If the peripheral extremity of one pneumogastric is

irritated in an animal breathing voluntarily, dyspnœa first develops during the slowing of the pulse. After cessation of the irritation, when the frequency of the pulse becomes very great, the normal respiration first begins, but is soon interrupted by a prolonged apnœic interval. Sigmund Mayer properly attributes the dyspnœa to the slowness of the pulse, and regards the apnœa as a result of the accelerated current of blood with increased frequency of the pulse. I have observed a somewhat similar condition on irritating the accelerator nerve in an experiment, temporary cessation of respiration occurring during the irritation. In like manner, acceleration of the pulse in man, whether manifested by palpitation or not, might produce apnœa. This subject requires further clinical observation.

Patients who are attacked by dyspnœa on bodily movement attempt to escape it by remaining at rest, and this proves successful in all cases in which the bodily movement was the sole cause of the dyspnœa. Those who become dyspnœic in the horizontal position raise themselves in bed, and the erect position often suffices to relieve the dyspnæa. If the dyspnœa continues when the patient sits up and this position only affords relative relief, the condition is called orthopnœa.

Sitting up affords relief because the flow of blood from the large veins to the right heart is somewhat impeded, and the distention of the right heart cannot occur to the same extent as in the recumbent position. In addition, respiration is more free and unimpeded while sitting up, and the auxiliary efforts of the scaleni and sternomastoids can be brought into play by bracing the arms. This is impossible in dorsal decubitus. Finally, the diaphragm descends to a greater extent in the sitting posture, because the liver, stomach, and intestines sink from their own weight.

A strong desire to pass urine sometimes appears during dyspnœa.

IV. Symptoms of Cardiac Asthma.

Here the dyspnœa is very great; as a rule there is orthopnœa. The feeling of oppression is very distressing, the patients complain of a feeling of constriction of the chest and a heavy weight, with great anxiety, often intensified to a sensation of impending death. Cold sweat appears upon the forehead and

body. As a rule, consciousness is entirely intact, but syncope sometimes occurs.

As in dyspnœa, palpitation of the heart accompanies the attack, but, as a rule, is felt only at the beginning. During the course of the attack, especially at its height, the palpitation falls into the background when compared with the other turbulent symptoms. The dyspnœa may be so severe as to make speech impossible. The patients become speechless but not aphasic. They fear to speak because inspiration is thus prolonged artificially and the active participation of the abdominal muscles is interfered with.

Involuntary micturition and even defecation sometimes occur during the attack.

The chief difference between dyspnœa and asthma consists in the conduct of the patients at the beginning and end of the attack. They attempt to escape dyspnœa by rest, but very often struggle against the asthmatic attack by movement. They jump out of bed, rush to the open window, walk up and down the room until they grow warm and perspiration breaks out. In very severe cases, however, in which the patients fall into a condition of great weakness, they must remain in the sitting position.

After an asthmatic attack the patient feels very exhausted and this may even persist until the following day. After dyspnœa he recovers in a little while.

V. Diagnosis of Cardiac Dyspnœa.

The first question concerns the diagnosis in the narrower sense, *i.e.*, whether the cause which lies at the bottom of the dyspnœa is essentially cardiac in character or whether the cardiac factor at least plays the principal part.

In order to answer this question, in general, we must examine for changes in the heart with the aid of physical methods. When valvular lesions are present, this examination will furnish a definite result, when they are not present, we must first direct our attention to changes in the size of the heart. These changes may be manifold in character.

Both sides of the heart may be enlarged; the enlargement may affect chiefly the right or left ventricle; or the auricles, particularly the left one, may undergo enlargement.

Such findings are very important in the diagnosis of cardiac dyspnœa, but to make it complete we must also ascertain the pressure in the arteries. A single measurement does not suffice to clear up the case. We must note whether, during bodily and mental rest, *i.e.*, at a time when the patient is not excited, the arterial pressure is decidedly lower than during moderate bodily movement or mental excitement; whether a change in the position of the body—passing from the erect position into horizontal decubitus—is followed by considerable increase in the blood-pressure. Such measurements also inform us concerning the degree of stability of the circulation, and we will learn whether the tendency to dyspnœa in the individual case coincides with such stability or its absence.

It is certainly of great value to combine measurement of the blood-pressure with the mapping out of the boundaries of the heart, as Scholl has done, because there is no doubt that the volume of the heart is as little constant as the blood-pressure. Scholl merits special praise for having shown the changeability of the size of the heart in a definite manner. This is not new to those who have had the opportunity of observing the exposed heart in living animals. On compression of the abdominal aorta the heart looks entirely different from what it does after compression of the vena cava. Irritation of the spinal cord and strychnine poisoning change the size of the heart materially; a heart that beats slowly looks different from one beating rapidly. If a patent example of the changeability in the shape of the heart is desired, let the experiment be made of bringing the organ under the influence of irritation of the pneumogastric and then under that of irritation of the accelerator; or watch the suffocation experiment, in which the heart is gradually paralyzed under the influence of the toxic action of the dyspnœic blood. The most surprising changes are exhibited when a heart poisoned with muscarin is again restored by atropine.

The changeability of the volume of the heart is not unknown to clinicians, but hitherto their attention has only been called to colossal enlargements of the heart or auricles, which appeared temporarily and then disappeared. Such cases have been described by Stokes and Traube, and Heiller described a case a few years ago. The latter constitute clinical rarities, and are not often seen in cardiac dyspnœa.

Although I am a firm believer in the variability of the size of the heart, I doubt the possibility of demonstrating this changeability upon the non-exposed heart with the aid of percussion in a positive manner.

This doubt is not based on a belief in the unreliability of the method of percussion or the skill of the observer, but upon the relations between the size of the lungs and the pressure in the pulmonary capillaries. If we assume that the pressure in the aorta is increased, two sets of changes in volume may occur, as is evident from our previous remarks. The increase of pressure may be associated with enlargement of both halves of the heart; this will happen when a normally acting heart is more filled than usual. In this event the heart and lungs become larger, and as the edges of the enlarged lung push across the heart, it may readily happen that the cardiac enlargement is not recognized. It may also happen that the heart grows smaller under increased pressure, and this will take place when the organ acted abnormally from the beginning, *i.e.*, exhibited a sort of insufficiency. When an insufficient heart begins to functionate normally, its volume grows smaller while the pressure in the arteries increases; in such cases only the arterial pressure rises, while the pulmonary pressure, which was relatively increased during the insufficiency of the heart, falls in comparison. Prior to such an event percussion might have appeared to show that the really enlarged heart was not enlarged, because the organ was covered to a greater extent by the enlarged lungs. Later, when the heart and lungs have become smaller, percussion is very apt to lead to the conclusion that the really small heart has become larger; the area of dulness is very apt to be increased by the retraction of the lungs.

Similar statements hold good with regard to the results of percussion of the heart, when the pressure in the arteries is low or falling.

Fall of the blood-pressure under normal conditions signifies diminution in the size of the heart and also of the lungs. Percussion may then mistake a larger heart for the really smaller one. Vice versa, when the arterial pressure falls as the result of cardiac insufficiency (and therefore the pulmonary pressure increases), the heart and lungs grow larger, while the heart may appear smaller on percussion.

I have made only one experiment similar to those of Scholl, and am therefore unable to state the amount of error that may arise from these relations. That such errors do exist may not alone be inferred *a priori* from theoretical considerations, but can be clearly proven clinically, as I showed recently in a case at the Policlinic under the control of my assistant, Dr. Schweinburg. In this case—arterio-sclerosis with cardiac dyspnœa—I mapped out the boundaries of the heart while the patient was breathing quietly. I then allowed him to walk rapidly about the room until dyspnœa developed, which occurred very soon in this case. Percussion during the dyspnœa showed that the heart had become decidedly smaller. Prior to the dyspnœa the dulness extended on the left side to more than one centimetre beyond the mammary line, on the right side to the middle of the sternum. During the dyspnœa the dulness began about two centimetres within the mammary line and extended only to the edge of the sternum. This diminution was certainly only apparent and depended upon the fact that the enlarged lung covered the heart more than before. It is more probable that the heart was enlarged, inasmuch as the arterial pressure had increased about twenty millimetres during the dyspnœa.

Future clinical examinations must take these errors into consideration. It is possible that in the measurement of relative cardiac dulness by percussion (in which we attempt to ascertain the absolute size of the heart) these errors do not impair the examination to such an extent as in the measurement of the area of absolute dulness (in which we measure only that portion of the heart which is uncovered by the lungs).

Hence, the changeability in the size of the heart, at least in slight grades, is ascertained with great difficulty. The changeability of the arterial pressure, on the other hand, is determined very easily by means of the sphygmomanometer. The fact that variations of arterial pressure in the same individual are readily detected with the sphygmomanometer is acknowledged by all investigators who use my instrument, even by those who deny that comparative study of the blood-pressure of different individuals can be made by its aid.

I do not agree with the latter opinion. I believe that the instrument will decide whether the blood-pressure of any indi-

vidual is high or low. But in such cases we must be extremely careful and employ all the precautions recommended in my treatise on the sphygmomanometer.

For further information I may here add that, according to my experience, figures under 80 mm. Hg. indicate low pressure, those above 120 mm. Hg. high pressure. This is true of measurements upon the temporal artery. The values obtained upon the radial artery suffer from an error of 20 mm. Here figures under 100 mm. Hg. indicate low pressure, those above 140 mm. Hg. high pressure.

We have said that it is important in the diagnosis of cardiac dyspnœa to examine whether the size of the heart is changed and to determine the condition of the blood-pressure. The relations of blood-pressure to the diagnosis will be discussed later. We will first inquire whether the diagnosis of cardiac dyspnœa may be made when no change in the size of the heart is demonstrable. Without question. The area of cardiac dulness may be normal, the heart-sounds clear, and nevertheless cardiac dyspnœa may be present. In such cases and also in those in which there is a deviation from the normal, the diagnosis of pure cardiac dyspnœa, without complications, can only be made by exclusion. In other words, we must be able to show by the examination that the primary cause of the dyspnœa can only depend upon increase of pressure in the pulmonary artery. This can only be proven indirectly by the aid of measurement of the blood-pressure. When the dyspnœa results primarily from other conditions, which I have discussed in the introduction, we can no longer speak of pure cardiac dyspnœa.

Nevertheless the cardiac factor also plays a part in those cases in which the dyspnœa starts primarily from the lungs; when the elimination of a part of the respiratory surface by destructive processes impairs the respiratory capacity or when catarrhal swelling of the mucous membrane and accumulation of secretion in the bronchi interfere with the entrance of air, or when the loss of pulmonary elasticity prevents retraction of the lungs during expiration and consequently the respiratory interchange of gases is diminished.

In all these cases the dyspnœa is direct, *i.e.*, the imperfect respiration arises from diminished interchange of gases in the lungs themselves. This dyspnœa, or rather the induced dysp-

nœal condition of the blood, must give rise to increased arterial pressure and with it to increased rigidity of the lung. This rigidity has a so much greater injurious effect in all these cases because the interference with the respiratory capacity affects a lung whose function was already impaired.

It must also be remembered that in these pulmonary diseases the heart does not always remain healthy. Weakness of the heart is very often present in tuberculosis, but particularly in pneumonia, and emphysema is often associated with arterio-sclerosis and those diseases of the heart which arise from the nutritive disturbances due to arterio-sclerosis.

In order to obtain a better oversight, it is well to divide the cases of pure cardiac dyspnœa into two groups. In the first group, which includes the milder cases, dyspnœa does not occur until the pulmonary pressure is materially different from that present during the period of eupnœa. In these cases the irritant which produces the dyspnœa must be pronounced, or there must be marked irritability as a result of which a slight irritant is followed by a notable effect.

To express myself somewhat more concretely, we must include in this group those cases in which the increase of blood-pressure in the arteries and secondarily in the pulmonary artery only occurs after great bodily strain or in which a moderate exertion increases the blood-pressure very considerably. This category also includes the cases in which great increase of pressure readily occurs after excitement of a psychical character.

The heart and the circulation in general here present entirely normal conditions. The arterial pressure may be normal or deviate very little from the normal. Even low pressure may be observed, but this will not depend on pronounced cardiac weakness.

To this group belong the cases in which the dyspnœa is caused by obesity. This may be interpreted as an exciting cause only in so far as every bodily exertion which includes lifting the weight of the body, involves a relatively greater exertion. It also includes cases of anæmic irritable individuals who have a predisposition to palpitation of the heart, and finally cases of beginning arterio-sclerosis in which the arterial pressure is increased somewhat above the normal.

During the dyspnœa, examination shows, in these cases,

increased arterial pressure, enlargement of the lungs, and uniform enlargement of the heart.

In the second group, which includes the more severe cases, slight increase of pressure in the arteries or the pulmonary artery suffices to produce a degree of pulmonary rigidity which gives rise to dyspnœa. In these cases the stimulus which causes the dyspnœa is very slight, a trifling increase of bodily labor or mere change of position of the body. This will always occur when the pressure in the pulmonary artery has been relatively high from the start, either because the arterial pressure is very high or there is low arterial pressure due to permanent insufficiency of the heart.

In these cases the heart and circulation exhibit abnormal conditions. Either the arterial tension is very high and with it there is enlargement of the heart and probably hypertrophy, or the arterial tension is low and, at the same time, the right heart is larger than the left, and perhaps the pulmonary second sound accentuated. Distinct swelling, at times even pulsation, will be visible in the veins of the neck; swelling, dilatation, varicosities will also be found in other veins of the body.

This group includes cases of severe arterio-sclerosis without valvular lesion but with high arterial tension, cases of nephritis in which there is also high arterial tension, cases of arterio-sclerosis in every stage of the disease when the arterial pressure has fallen as the result of insufficiency of the heart, cases of general lipomatosis with weakness of the heart as the result of fatty degeneration of the heart muscle, and finally those cases of cardiac weakness which develop after acute infectious diseases, such as typhoid fever and diphtheria.

In these cases the arterial pressure will be found to be increased during the attack of dyspnœa. In cases of general cardiac hypertrophy, as in the first stages of arterio-sclerosis and in contracted kidneys, the enlargement of the heart during the dyspnœa will be general. When the increase of blood-pressure occurs in insufficiency of the heart, the right half probably undergoes greater enlargement than the left half. Distinct swelling or enlargement of the lungs can be demonstrated uniformly.

VI. Diagnosis of Cardiac Asthma.

As we have already remarked, the asthmatic attack is distinguished from dyspnœa chiefly by its suddenness. For this reason it was generally attributed to spasm. As the idea of spasm is always connected with the muscles, that form of asthma in which spasm of the bronchial muscular fibres or the diaphragm was assumed, has hitherto received more attention.

The term cardiac asthma has been restricted to those cases in which spasm of the diaphragm, bronchial muscles, or glottis can be excluded, and the causation is sought in the heart alone. All are agreed that suddenness does not distinguish nervous asthma with its different varieties from cardiac asthma. The sudden occurrence of cardiac asthma has not been explained hitherto. We have been satisfied with the notion that it is caused by cardiac failure. The small, feeble, barely perceptible pulse was regarded as the chief diagnostic sign. The answer to the question as to the explanation of the suddenness of cardiac asthma is no longer attended with difficulty.

Whoever has seen the lungs lose their distensibility at once after compression of the aorta or the injection of muscarin, will readily understand the suddenness of asthma. It is due to the rapidity with which the pulmonary rigidity develops.

We will hereafter consider the cardiac findings in the inter-paroxysmal period and will now discuss the attack itself from the diagnostic standpoint.

Two forms of asthma must be distinguished: 1, prodromal asthma; 2, asthma proper.

The diagnostic signs of prodromal asthma consist of great increase of the blood-pressure, *i.e.*, a very full, vigorous pulse, clearly demonstrable enlargement of the lungs as the result of swelling, and uniform enlargement of the heart.

The attack may consist solely of prodromal asthma and may subside as such. The prodromal asthma may also pass into asthma proper, and this transition may take place with more or less rapidity. It is attended with rapid fall of the blood-pressure, *i.e.*, with striking enfeeblement of the pulse.

Starting with the principles laid down in the section on "Pathology of Asthma," we must divide asthma proper into three varieties.

In the first variety the fall of blood-pressure is attended with that form of cardiac paresis in which the left ventricle mainly undergoes enlargement. The diagnostic signs, so far as regards the heart, are the following; the area of dulness increases on the left, and perhaps extends far beyond the mammary line. The apex-beat, more or less localized before the attack, becomes more diffuse and is superficial, undulating.

Toward the sternum the enlargement of the area of cardiac dulness is not demonstrable, and if it were present, the examination would show that it depends chiefly upon the left ventricle. The examination would have to take into consideration the difference between the sounds of the right and left heart rather than the area of dulness. As the action of the left heart is chiefly impaired, muffled, perhaps very feeble heart sounds would be heard over its entire area. This is true particularly of the first sound on account of the part played by muscular action in its production. If the dulness over the sternum corresponds to the left ventricle, then the muffled sounds of the left ventricle would be heard in that locality.

Over the right ventricle, whose action, on the whole, is very little changed and may even be intensified at a certain time, distinct sounds must be heard and there may even be temporary distinct accentuation of the second pulmonary sound.

In the second form of asthma proper, in which, according to my theory, the cardiac paresis that has caused lowering of the blood-pressure develops without relaxation and dilatation of the heart, and hence dilatation of the right ventricle, whose thin walls are more distensible, must develop, the dulness would first be increased toward the side of the sternum. But as distention of the left heart may increase the area of dulness on the right side, so distention of the right heart, when very marked, may also increase the dulness to the left, *i.e.*, beyond the mammary line. The question, whether the dulness on the left side belongs more to the right than to the left ventricle, must be decided by the careful examination of the heart sounds on the two sides. According to our assumption, the sounds over the right heart could not be so clearly distinguished by their intensity from the weaker sounds of the left heart. The apex-beat, in so far as it belongs to the left heart, would be weaker but not so diffuse as before; on the other

hand, there would be strong epigastric pulsation starting from the right heart. Careful examination would also show considerable dulness in the region of the left auricle.

The third form of asthma proper could hardly be distinguished clinically from those just described, so far as regards the diagnostic signs referable to the heart, because dilatation of the right heart, and dilatation and fulness of the left auricle, would be characteristic phenomena. This variety would only be distinguished from the others by the etiological element, *i.e.*, by the cardiac spasm which induces the changes mentioned.

The diagnostic signs of the last two forms of asthma just furnished, apart from their theoretical foundation upon experiments on animals, are by no means so hypothetical as we might believe. The literature contains a number of cases in which the same diagnostic signs which we have deduced from experiments, are described. The most pertinent one is the case of sudden asthma observed by Albutt upon himself and carefully described. On account of its importanec I will here quote literally. "I was attacked quite suddenly by a strange and peculiar want of breath, accompanied by an extremely disagreeable sensation of fulness and pulsation in the epigastrium. On placing my hand upon my heart I felt a labored diffuse beat over the entire epigastrium. I opened my shirt at once and convinced myself by percussion that the right ventricle was dilated very considerably. I therefore threw myself upon the grass at full length with the shoulders raised, and in a few minutes enjoyed the satisfaction of finding that the dilatation of the heart, the oppression, and the cardiac dulness were diminishing. I was then able to rise and sit down and even to walk on the level, but the symptoms returned as soon as I began to ascend."

Stokes describes, in his well-known work on Diseases of the Heart, a case of sudden dilatation of the left auricle in an attack of cardiac asthma. Barié (quoted in Fraenkel's article on Asthma in Eulenburg's Encyclopædia) speaks of dyspeptic asthma in which, according to him, the right heart is enlarged; in this case the cardiac dulness was increased to the left, and this circumstance led Fraenkel to believe that the right heart was not enlarged. But as Barié expressly emphasizes the accentuation of the second pulmonary sound, his

opinion that he had to deal with enlargement of the right heart was probably more correct. The direction of dulness alone does not decide the question whether the right or left heart takes the greater part in the enlargement.

I concede willingly that the clinical observations are too few to permit us to base upon them alone the theory of spasm or retraction of the heart. But a theory which is founded firmly on experiment and is supported by post-mortem findings, a theory which is supported even by a few clinical observations, is not founded on air and must be taken into consideration in clinical observations. I have no doubt that what has been seen in rare cases by a few excellent observers will be seen more frequently. That these observations should be so rare is not astonishing. Patients suffering from cardiac asthma are very rarely seen during an attack, especially when they occur at night. Even when they are seen during the seizure, the chief attention is directed to the threatening symptoms—the pulse is felt and the heart auscultated, but only in order to ascertain its general condition. The lungs are auscultated in order to determine whether œdema is beginning, but careful examination is omitted, as a rule, in order to spare the patient. But when the path of examination is mapped out more strictly, there will soon, I hope, be no dearth of observations which will inform us concerning the condition of the heart during asthma, and it is to be expected that these observations will be in harmony with the few already made and with the theories here advanced.

In the last two forms of cardiac asthma the pulse is less tense, corresponding with the diminished arterial pressure. In the spasmodic form, if there be such a form, the soft pulse would be larger than in the paretic form. I deduce this sign from experiment; clinical observation must show whether it holds good.

In all three forms of asthma, swelling or enlargement of the lungs must be demonstrable.

Enlargement of the lungs during an attack of asthma has been regarded hitherto as the most important sign of bronchial asthma. The occlusion of the finest bronchi—whether from spasm, acute catarrh or bronchiolitis, as assumed lately, was supposed to act like a valve, which permits the entrance of air but interferes with its exit. In this way it was sup-

posed that more air would be stored in the alveoli and distend the lungs. In accordance with this, the percussion sound in bronchial asthma approaches the tympanitic character, and Biermer's so-called "box" sound is heard on percussion.

I do not wish to enter upon the theory of bronchial asthma; but, in my opinion, enlargement of the lung as such can no longer be attributed solely to occlusion of the bronchi. From the standpoint of differential diagnosis, the enlargement can no longer be regarded as pathognomonic of bronchial asthma. But it is possible that the distended lung of bronchial asthma is distinguished by the "box" sound from that of cardiac asthma.

The most important distinctions between the two conditions must be sought—apart from the etiological factors, *i.e.*, previous catarrh of the bronchi—in the results of auscultation during the asthma and in the character of the respiration. In cardiac asthma no abnormal respiratory murmurs are heard, so long as œdema of the lungs does not develop. The respiration is feeble, as a rule, and coarse râles are heard only at the close of the attack. When œdema occurs during the attack, distinct crepitant râles are heard and it is often possible to demonstrate slight dulness in places. In cardiac asthma the dyspnœa is general, *i.e.*, mixed; both inspiration and expiration are prolonged and labored. All observers agree that the respiration is slowed, not accelerated.

In bronchial asthma, auscultation shows numerous obstructions to the entrance and exit of air, which are recognized by the whistling, rattling, wheezing, and numerous rhonchi. The striking feature is the difficult expiration, which is attended with loud, high-pitched, sighing sounds, and distinct strain of the expiratory muscles.

Two years ago I had the opportunity of seeing an attack of pronounced bronchial asthma and of measuring the blood-pressure during the attack. The pressure was increased to a very high degree. Measured at the radial artery the pressure usually amounted to 150 mm. mercury, but during the attack it rose to 200 mm. This great increase was undoubtedly produced by the dyspnœa which was due in turn to the impeded respiration.

Can a bronchial asthma, which is attended with increase of blood-pressure, be regarded as pure bronchial asthma? I

think not. The increased pressure must give rise to pulmonary rigidity and, if we assume that the bronchial asthma began only with dilatation of the alveoli, then, when the dyspnœa in the course of the attack increases the blood-pressure, swelling and rigidity of the lungs must develop. In other words, bronchial asthma under high arterial pressure is no longer a pure bronchial asthma, but is a combination of this form with prodromal cardiac asthma.

In every attack of bronchial asthma in which we find a full, very tense pulse, we must therefore make the diagnosis of this combined condition. It is very probable that bronchial asthma is also combined with cardiac asthma proper, and this will be the case when the pulse is small and feeble during the attack.

The predisposition to cardiac asthma depends only in slight part upon the condition of the lungs during the inter-paroxysmal period. We observe attacks occasionally in individuals who suffer from more or less severe emphysema, and I have also observed it in a case of pulmonary phthisis, but the condition also occurs in individuals whose lungs are otherwise perfectly normal.

Dyspeptic asthma belongs in the front rank of those forms of cardiac asthma in which the lungs are perfectly normal.

This variety is decidedly a cardiac asthma and is so regarded by Fraenkel in his article in Eulenburg's Encyclopædia. Henoch has called special attention to this form and explains it by the experiments of Mayer and Pribram which showed that distention of the stomach increases the blood-pressure and irritates the central ends of the pneumogastric. The relations of these experiments to dyspeptic asthma have become much clearer since I have shown, from a new standpoint, the part played by increase of blood-pressure in dyspnœa and asthma. We now easily understand how dyspnœa or a prodromal asthma is produced by distention of the stomach and intestines, if this has been followed by increased blood-pressure. As is easily seen, the two most important conditions for its development are here combined, viz., the pulmonary rigidity and swelling as the result of the increased blood-pressure, and the respiratory insufficiency due to elevation of the diaphragm.

Dyspeptic asthma will remain a prodromal asthma so long

as it is associated with high blood-pressure. It may also be converted into asthma proper when the heart falls from its condition of equilibrium in any of the ways mentioned above. As in the experiments of Mayer and Pribram, the slowing of the pulse may also occur during dyspeptic asthma in its prodromal stage and for the same reasons. This slowing of the pulse may be absent in the second stage in which the blood-pressure is lower, and even acceleration of the pulse may occur at this time.

Barié's case favors the view that, in dyspeptic asthma, the heart passes out of the condition of equilibrium in that form in which there is dilatation of the right heart.

It must be left undecided whether the distention of the stomach and intestines produces asthma merely in a reflex manner, *i.e.*, by irritation of the vaso-motor centres; or whether a condition of paralysis or irritation of the diaphragm is not produced in another reflex manner as in the act of vomiting, which is associated with spasm of the diaphragm and the expiratory muscles; or whether a part is not played by toxic influences as the result of absorption of gastric and intestinal gases or of ptomaines developing in the contents of the digestive canal and which might possibly act like muscarin.

As is well known, dyspeptic asthma subsides with eructations or passage of intestinal gases. It is questionable whether the diminished tension of the stomach and intestines or the escape of the gases in a chemical sense plays the principal part.

In many cases, uræmic asthma is undoubtedly a pure cardiac asthma. In individuals who suffer from nephritis, the arterial tension is very high, as a rule, and hence the predisposition to asthma is very great. Prodromal asthma as well as asthma proper are very apt to develop. If we take into consideration that pulmonary œdema develops very often in such cases, we might be led to infer that paretic retraction or spasm of the heart is most apt to occur here, because these forms favor the production of œdema of the lungs. But it must also be taken into consideration that the hydræmic condition of the blood may favor the transudation of fluid into the alveoli.

The increased transudation from hydræmic blood causes

the development of cerebral œdema in these cases. This œdema may act secondarily upon the heart, by irritation of the central origin of the vaso-motor or cardiac nerves, and thus indirectly on the lungs. The coma, which sometimes occurs during the asthmatic attack, is connected with the œdema. It cannot be denied, however, that toxic influences due to the retention of certain substances in the blood may play a part in uræmia, and possibly give rise to the asthma or coma.

Attacks of asthma have also been observed in a few cases of lead poisoning. As the arterial tension is very high in lead poisoning, it may be assumed that we have to deal here with cardiac asthma. The causes for the development of the latter are present in the same manner as in arterio-sclerosis and nephritis.

In the inter-paroxysmal period we must examine the condition of the heart, pulse and lungs with regard to the diagnosis, and may classify the cases into groups.

The first group includes cases of arterio-sclerosis and aortic lesions due to sclerotic changes. These are characterized by enlargement of the heart, especially of the left ventricle, and a high tension pulse. Cases of nephritis, in which attacks of cardiac asthma occur, also belong to this group.

The second group inludes cases of low arterial tension and valvular lesions of the left venous orifice. Here the enlargement of the heart, when present, will affect chiefly the right side of the heart.

As regards the anatomical diagnosis, we may only speak of fatty heart (in which the function of the heart muscle has suffered in a notable degree) in those cases of the second group in which the blood-pressure is very low, excluding those in which considerable lesions of the mitral valve cause the slight filling of the arterial system. In the cases of the first group we may assume those changes in the structure of the heart which result from arterio-sclerosis.

"Special attention must be paid to the condition of the lungs because from this we must decide whether the attack is pure cardiac asthma or a mixed form of cardiac and bronchial asthma. If catarrh is demonstrable in the lungs or bronchi, we must ascertain whether it is primarily pulmonary in character or only a sequel of those circulatory disturbances which

lead to the dyspnœa or cardiac asthma. As a rule, this question cannot be answered by a single examination, but only by continued observation, the success or failure of therapeutic measures being also taken into consideration."

Nor is it easy to decide whether a demonstrable enlargement of the lung is due to true emphysema. In this regard we must always remember that high arterial tension as such causes swelling of the lung, and that the possibility of high pressure in the pulmonary artery and hence pulmonary swelling must be thought of even when the arterial tension is not high. The differential diagnosis between pulmonary swelling —perhaps Traube's volumen pulmonum auctum also belongs here—and pulmonary emphysema is therefore worthy of more consideration. The emphysema may be demonstrated on autopsy; whether this is true of swelling of the lungs must be determined by future investigations.

Theoretical considerations seem to show that emphysema probably constitutes a constant condition, pulmonary swelling a variable condition during life.

VII. Course and Terminations of Cardiac Dyspnœa and Cardiac Asthma.

Cardiac dyspnœa ceases with the cessation of the causes that have produced it, *i.e.*, in bodily rest or changed position of the body. Prodromal asthma may also subside spontaneously when the blood-pressure sinks.

This spontaneous lowering of the blood-pressure can only be explained by the notion that the irritation of the vasomotor centre, after it has lasted a long time, diminishes on account of exhaustion, and that the vessels of the greater circulation dilate as the result of this diminished irritability, despite the existing dyspnœa. With the increased flow of blood from the left heart the pulmonary vessels will also be emptied, the pulmonary rigidity will diminish in a corresponding measure, the distensibility of the lungs becomes greater, the dyspnœic respiratory movements cause thorough ventilation of the blood, and the dyspnœic blood is thus converted into eupnœic blood. As a matter of course, the attack then subsides.

In asthma proper, the power of the heart must be increased

before the attack will subside. The patient instinctively attempts to intensify the heart's action by bodily movement or changed position of the body (in Stokes' well-known case the patient bent his head to the ground and thus escaped the attack). Such procedures sometimes abort the attack. The exhaustion of the vaso-motor centre or the dilatation of the vessels may also act favorably, in so far as this entails the more ready passage of the blood from the lungs. As a matter of course, this can only occur when the paresis of the heart is not very marked.

As regards the sequelæ of dyspnœa and asthma, it must be kept in mind that the dyspnœic blood, on account of its poverty in oxygen, has an unfavorable influence upon the heart. The nutrition of the organ, which is frequently traversed by the dyspnœic blood, must be affected unfavorably, and as the insufficiency of oxygen favors fatty degeneration of the albumin, according to A. Fraenkel's experiment, frequently recurring dyspnœa or asthma may give rise to fatty degeneration of the heart. Unfavorable nutritive conditions also arise from the fact that the nutrient vessels of the heart and rest of the body are narrowed by the dyspnœa, so that the amount of blood supply is also changed unfavorably in every dyspnœa or asthma.

In addition to the direct injury to the heart muscle, the repeated increase of intracardial pressure distends the heart muscle and, as a result, there may be permanent malformation (dilatation of one or both ventricles).

VIII. Treatment.

In the treatment of different affections which have one cardinal symptom in common—in our case dyspnœa—individualization is only possible when we have clear conceptions of the physiological character of the affection in each individual case. But the most important part is played by experience because it alone can inform us concerning the true value of the conceptions by which we are guided in treatment.

In this manner I will discuss the treatment of the affections under consideration.

In the milder cases we must pay the chief attention to the causal indication, because we start with the assumption that

the heart itself is sound. Here the increase of the weight of the body is the principal cause of the dyspnœal symptoms and its reduction is the most important object of treatment. This reduction should be confined, if possible, to that tissue whose overgrowth is useless or even injurious to the body and necessitates superfluous work in locomotion. The question simply is, How is the excess best removed, what mode of reducing obesity is the best? The principle is simple: increase the consumption of fat and spare the albuminoid substances.

The consumption of fat is attended by processes which furnish carbonic acid and water as final products, when these processes furnish the material from which the final products are obtained. These processes include particularly increased muscular effort and production of heat. The stored-up fat must supply the material for these processes when the carbohydrates, ingested in the food, no longer suffice. The albumin of the body is saved from loss when the deprivation of carbohydrates is not carried too far. All modes of treatment of obesity, whatever may be their name, vary within these limits.

Simple as these requirements may appear from a theoretical standpoint, it is difficult to meet them in the individual case.

A rational procedure requires that, in the individual case, we ask whether the chief importance should be attached to an increase of the processes which stimulate consumption or to a diminution of fat-producing food.

Under certain circumstances measures which meet the first requirement will suffice. It is often found that a few pedestrian trips suffice to reduce the weight of the body by a few kilogrammes. Hence, when there is no special indication, we may simply recommend increased exercise to obese individuals who begin to complain of dyspnœa. In giving this injunction, however, we must always consider the habits of the individual and avoid a sudden transition to others. This rule is clear if we remember that we are unable to gauge properly the effect of such sudden transitions. The increased exercise must not degenerate into hard work which is followed by exhaustion, and special care is to be taken that the condition which we desire to remove by the exercise, viz., the dyspnœa, is not increased by the exercise itself. As we have mentioned above, dyspnœa always indicates the presence of a poor quality of

blood, imperfect filling of the capillaries, over-distention of the veins, and thus an unfavorable nutritive condition of the body. The frequent return of such a condition can hardly fail to be attended by permanent bad effects.

The increase of bodily work may be recommended in various ways. The simplest is to direct the patient to walk more. At first he should walk upon the level, but he may pass gradually to climbing.

The subjective sensations of the patient are the only measure of the sufficiency of the exercise. We may, however, give directions as regards the duration of the exercise. We may begin with one to two hours and then increase to six hours, sometimes even more. The distance to be traversed in the time mentioned must always be left to the patient himself.

No objection is to be made to Scholl's recommendation to begin with light gymnastics, provided we are convinced that it does not produce a greater strain than mere walking. But it must be remembered that gymnastic exercises produce a much greater effect, because larger groups of muscles, which are usually not employed vigorously, are then brought into action. Gymnastic exercises, which effect distention of the thorax, are undoubtedly useful in improving respiration. This I observed in my service at the Policlinic in a young man who had formerly suffered a good deal from palpitation of the heart and difficulty in breathing; both symptoms disappeared after he engaged in rowing. Inspection showed that the pectorals were remarkably well developed in this otherwise feeble individual.

As already mentioned, the consumption of the bodily fat is increased during muscular work, if the introduction of carbohydrates is diminished at the same time.

The extent to which we must go in this direction cannot be determined before treatment. At all events the plan for the changed diet must be formed in accordance with the previous mode of life of the patient and the condition of his digestion. Very often almost no change in the diet can be made. In many cases, on the other hand, very decided changes may be made in the amount and constitution of the food.

Dietetic treatment should never be carried to excess, and to define the limits in this direction is one of the most difficult problems in the treatment of obesity.

In accordance with the principles laid down in prescribing bodily exercise, I also plead here for mild methods. I am no friend of so-called vigorous treatment. As a matter of experience, the latter does not effect very much in reducing the weight.

How often have I seen that, among different patients of apparently similar constitution, the weight of one diminished more than three times that of the other. When the latter, envious of the brilliant results of treatment in the former, imposed upon himself the greatest possible abstinence, it was found that he grew only weaker, but not materially lighter than before. The effect obtained was disproportionate to the abstinence and, what is most important, to the injurious effects whose real extent cannot be measured. Scholl has properly called attention to the dangers which may arise from over-treatment of obesity.

The question of diet has been discussed so much of late years that it may seem superfluous to say anything further. The general principles are quite firmly established, their execution must be regulated by the physician and patient in each individual case.

In the last few years deprivation of fluids has been recommended in addition to reduction of the carbohydrates. This advice is based on the idea that the diminished ingestion of fluids diminishes the amount of blood in circulation and that such diminution is capable of relieving the dyspnœa. I have already shown that weighty objections may be raised against this view. According to the new theory of cardiac asthma which I have here advanced and which can only be overthrown by proving that my data are wrong, this idea must be regarded as erroneous. In favor of this reduction of fluid can only be mentioned its supposed results in practice and the increase of the renal secretion which, according to Feilchenfeld's corroborative experiment, it is said to have. The practical results, however, have been denied by various observers. As regards the increase of the urinary secretion, it is by no means clear upon what it depends and what it signifies. It is very possible that the increased secretion of urine after deprivation of fluid indicates a condition similar to diabetes insipidus. At all events, the contrary has not been proven.

The loss of fat can also be aided considerably by the inter-

nal use of waters containing Glauber's salts and sodium chloride (Marienbad, Tarasp, Karlsbad, Kissingen, etc.). So far as I can judge from my own experience, waters containing Glauber's salt are admirably adapted to this purpose. It can very often be noted with certainty that their use diminishes the weight of the body even when the consumption of fat has not been increased by exercise, and the improvement may even be observed when there has been no restriction in diet.

Baths (carbonated, brine and vapor baths) are also therapeutic aids in this direction, because they stimulate the nutritive processes, increase the production of carbonic acid, and the urinary and cutaneous secretions.

Increased exercise may also be useful in those mild cases without demonstrable changes in the cardiac function, and in which the increased weight of the body due to the abundance of adipose cannot be regarded as the exciting cause. The cause of improvement is not to be sought in the reduction of weight, because this is not even desirable here, but in other circumstances. Among these, habit occupies the first rank. We can readily conceive that in individuals who lead a too quiet life, either for extrinsic reasons or because they feel too weak, a slight excess of movement will produce dyspnœa and that in consequence of the muscular rest there develops an increased sensibility to the dyspnœal stimuli produced by muscular exertion; in addition, the muscular respiratory apparatus, which has become lazy, loses its regulating capacity. In such cases exercise secures the therapeutic objects of blunting the sensibility and of stimulating the regulating capacity of the respiratory mechanism. Walking and cautious, progressively increasing climbing constitute respiratory gymnastics in such cases and it is also advantageous to pay special attention to the muscles of the thorax. This form of dyspnœa is found in young anæmic and chlorotic individuals and also in neurasthenics.

The dyspnœa of chlorotic and anæmic individuals has been associated by various writers (Sée, Brunton) with the imperfect ability of the blood to take up oxygen. Such a condition of the blood really favors dyspnœa in so far as every muscular effort, when the absorption of oxygen is diminished, signifies a relative increase of the carbonic acid, *i.e.*, an increase of the dyspnœal irritation of the blood. But the dyspnœa of anæmia

and chlorosis is, in reality, a cardiac dyspnœa. This view is in harmony with the fact that, in such cases, we often find a tendency to palpitation which is probably dependent on the dyspnœal irritation of the vascular system that is apt to occur, and that, as I have observed in a number of cases, is followed by increase of blood-pressure. [Perhaps this fact also stands in causal relation to the tendency to cardiac hypertrophy in such cases to which Sée has called special attention.]

Bodily exercise also has another object, viz., to secure permanent increase, if possible, of the heart's action. This is particularly indicated when measurement shows the existence of very low blood-pressure.

In such cases we must overcome the opposition of the patient to walking and insist upon it even when it is connected with slight dyspnœa. This sends more blood to the heart than usual, and, as a matter of experience, it is found that the dyspnœa is soon overcome by the more vigorous respiration. The diet should be stimulating. Wine and beer are to be recommended in these cases, despite the dyspnœa and the vascular changes which often produce congestions. If there is a tendency to obesity this must be taken into consideration, as a matter of course, in prescribing diet. The internal administration of iron and arsenic is often useful. When the blood-pressure appeared to be especially low, I have used strychnine or tincture of nux vomica with success. Lukewarm baths—carbonated iron baths and mud baths—are auxiliary remedies.

Whether the dyspnœa of neurasthenics is cardiac in character, cannot be ascertained with certainty. The cardiac factor undoubtedly plays an important part in certain cases in which great irritability of the vascular system and heart is demonstrable. Such cases must be treated with great caution. The condition of the patients is sometimes improved by bodily exercise, sometimes it is made worse. When the dyspnœa is produced not alone by movement, but is also noticed during rest, as the need of taking deep breath frequently, medicinal treatment is also indicated. I have seen some good results from strychnine and nitroglycerin. Neurasthenics react in a different manner to baths as they do to exercise. Mild cold-water cures sometimes act favorably, but cold is often tolerated poorly. In the latter event it is advisable to try lukewarm baths. Neurasthenics are sometimes very sen-

sitive to baths containing carbonic acid; mud baths are tolerated much better.

In the severer cases of dyspnœa which are due to demonstrable valvular lesions or to supposed structural changes in the heart as shown by functional changes, special attention must be paid in treatment—apart from the data furnished by examination of the heart—to the results of measurement of the blood-pressure or the condition of the pulse.

As regards immediate interference, it is not immaterial whether we have to deal with a patient with high arterial pressure, *i.e.*, a high tension pulse, or low arterial pressure, *i.e.*, a soft pulse. It is also very important to note the change of blood-pressure uninterruptedly during the course of treatment.

We will first consider those cases in which the arterial pressure has been found to be high, *i.e.*, those in which there is very probably arterio-sclerosis or valvular lesions as the result of arterio-sclerosis.

So far as regards treatment, we must here distinguish between cases which are associated with obesity and those in which arterio-sclersois is unattended with this anomaly of nutrition or is even combined with distinct emaciation.

Cases of arterio-sclerosis with general lipomatosis, so long as the vascular tension does not exceed the normal to a great extent, are subject to the same principles of treatment as simple obesity. These are the cases which usually figure in practice under the head of abdominal plethora.

Cautious exercise and moderate regimen for obesity will play the chief part; and special aid is derived from the therapeutic measures which give rise to derivation. Care must be taken to secure copious evacuations from the bowels, if necessary by the use of purgatives. The abdominal cavity is thus reduced in size and the intra-abdominal pressure diminished. This aids in diminishing the arterial pressure. With the lowering of the pressure in the arteries the swelling and rigidity of the lung will also diminish. The distention of the lungs becomes easier and respiration may become more free, especially when, on account of the evacuation of the bowels, the excursions of the diaphragm are no longer interfered with and the weight of the body has diminished under treatment. The favorable effect of those mineral water cures, which stim-

ulate the evacuation of the bowels, undoubtedly depends on this action. Traube called attention repeatedly to the importance of purgation in arterio-sclerosis. Nevertheless, this important factor in the treatment of certain circulatory disturbances has been undervalued of late years; and some writers even warn against the use of purgatives. It is true that the continued use of strong purgatives may be injurious to the intestines, and may give rise to chronic catarrh with increasing atony of the muscular coat of the intestines. The latter condition is combated less easily than the former and leads to the necessity of administering progressively increasing doses.

But if, in cases in which the tension of the pulse is high, we reflect which is the lesser injury, the high tension and its effects upon the heart, circulation, respiration, etc., or the injurious after-effect of purgatives, we will hardly waver in an our choice and will continue purgation. In my experience, moreover, the after-effects of purgatives are not so injurious as is generally believed. I know individuals who for years have taken aloes daily and feel perfectly well. As a rule, purgatives are not injurious until their action begins to flag. In the same way, as I know by experience at Marienbad, the use of saline laxative waters is injurious only so long as they do not purge, however abundant the urinary secretion may be. Under such circumstances the patients complain of labored breathing, distended abdomen, loss of appetite, rush of blood to the head, etc.

The use of baths, in these cases, possesses the advantage of increasing the consumption of fat. But on account of the injury which may accrue from any increase of the blood-pressure, we must convince ourselves by tests whether any reaction, which points to such an increase, becomes noticeable immediately after the beginning of the bath, during or after the bath. There is no doubt that baths may act as a stimulant. In a case of this kind I measured the blood-pressure and found it considerably higher than in the patient's normal condition. Such an elevation has little significance in individuals with a weak pulse, but it is important in cases in which the tension of the pulse is already higher than normal. Warm baths may also act in a decidedly favorable manner in such cases by dilating the cutaneous vessels and, in a reflex way, the

abdominal vessels, and thus diminishing the pressure in the aorta. Whether this is also true of vapor baths or whether they do not rather give rise to considerable elevation of blood-pressure, I do not know and on this account I avoid ordering vapor baths in cases of arterio-sclerosis. Nor do I regard cold baths as indicated, on account of their action in increasing the blood-pressure. Cases have been reported in which violent dyspnœal symptoms developed after cold baths and even increased to asthma. Such cases also warn us to be cautious.

In cases of arterio-sclerosis in which obesity is not present, we dispense with those therapeutic measures which are intended for the consumption of fat, and it only appears necessary to bring the pulse into a condition of the lowest possible tension. This is effected chiefly, as we have already said, by the use of purgatives. When these have produced relief, a diet must be maintained which prevents the accumulation of fæcal masses as much as possible, viz., a milk and meat diet, no leguminous or farinaceous food, but especially no potatoes. In such cases the urinary secretion is more abundant than usual and there is no reason for therapeutic interference in this direction.

Alcoholic drinks, in large amounts, are contraindicated for the reason that alcoholism is known to be one of the causes of arterio-sclerosis. But it is not advisable to deprive the patients entirely, especially when they are advanced in years, of the use of alcohol in the form of wine or beer.

All forms of excessive exercise must be carefully avoided. The patient may be allowed moderate exercise, if it can be performed without dyspnœa; occupations attended with bodily strain must be interdicted.

In addition to purgatives and suitable dietetic regimen, we may also resort, when necessary, to cardiac remedies. One of the mildest of these, according to my experience, is atropine in very small doses. My prescription reads: sol. atropiæ sulph. (0.3%), 1.0, aq. destill. 150.0, one tablespoonful every three to five hours. Formerly I used atropia only in arhythmia, starting with the physiological notion that it made the heart insensible to irritation of the vagus. I then found that it also acts favorably upon dyspnœa and have since employed it when arhythmia as not present. I have obtained good results in my service at the Policlinic and also in my private practice in

Marienbad. Atropine I have used only for a year; formerly I gave the extract or tincture of belladonna, the former in doses of 0.01 p. d., the latter five to six drops p. d.

When atropine alone is unsuccessful, we should resort to digitalis. In former years, on the basis of theoretical considerations, I regarded the high tension of the pulse as a contra-indication to the use of digitalis. I was strengthened in this opinion because my sphygmomanometric measurements showed that in cases of low tension of the pulse, in which I used digitalis, the improvement of the respiratory disturbances was often associated with increasing arterial pressure.

Experience has taught me, in opposition to this opinion, that digitalis sometimes acts favorably when it is used in cases with high tension pulse. Such a result involves no contradiction, but is rather to be expected on closer study. High arterial tension does not exclude, as I have already shown, a high tension in the venous system and the lesser circulation. Therapeutically, however, we have to deal much more with the removal of the two latter symptoms. If, as may be assumed, digitalis is able to do this, then its good effects are readily explained. Hence the indication for the use of digitalis resides, in my opinion, not so much in the condition of arterial pressure as it does in that of the venous pressure. When there are signs of the increase of the latter—swelling or pulsation of the cervical veins—digitalis should be administered. It is particularly indicated when high arterial pressure gradually diminishes with the increasing dyspnœa and when greater swelling or pulsation of the cervical veins sets in, because this is due undoubtedly to diminished activity of the heart. When the arterial tension is very high constantly or exhibits a tendency to increase still more, it is questionable whether digitalis should be given.

For some time I have been in the habit of giving digitalis in combination with atropine, 1 gm. of 0.3% solution of atropine being added to 150.0 of an infusion of varying strengths. In a series of mild as well as severe cases and also in cases of severe valvular lesions, I have convinced myself that digitalis, with this addition, is well borne for a long time. In the comparative tests which I made, it seemed as if the combination of digitalis and atropine had a better effect on the heart than digitalis alone. I may take this opportunity of remarking

that this form of medication is also based on experimental experience. Experiment shows that the injection of such a mixed solution into the jugular of a dog produces an increase of blood-pressure which apparently lasts longer than that produced by infusion of digitalis alone. A striking feature in this experiment was the condition of the venous pressure, which fell materially despite the high and constant increase of arterial pressure.

In such cases I also order lobelia in addition to atropine and digitalis. I prescribe a mixture containing 2 to 3 gms. tinct. lobeliæ to 150.0 water and add to this 1 gm. of the 0.3% solution of atropine. I have observed a number of cases in which this treatment was followed by tolerably favorable results.

The cases in which examination with the sphygmomanometer shows very high tension—in my experience such cases have a radial tension of 180–200 mm. Hg.—must be treated with special caution. If obesity is also present, we must attempt to reduce the weight by suitable diet. The urine must always be examined for albumin in these cases. When it is not found, we may attempt to reduce the ingestion of fluids as much as possible. On account of the rigidity and unyielding character of the walls of the vessels it is possible that the increased absorption of fluid may lead to increase of blood-pressure, and this, however slight, is to be avoided at any cost. When albumin is present in the urine, we must avoid excessive reduction of fluids because the danger of producing uræmia artificially by such means is not excluded.

As the lungs are already swollen[1] on account of the enormous increase of the blood-pressure and hence dyspnœa occurs from very slight causes and very moderate exercise, we may only permit walking on the level at the beginning of treatment. Climbing should be allowed only after noticeable improvement has occurred. As a matter of course, purgation is more important in such cases than in others. I am in the habit of giving atropine when irregularity of the heart's action (arhythmia) is demonstrable, also in the galop rhythm and

[1] I have recently demonstrated this enlargement of the lungs in an exquisite case. The patient was a very stout man, aged 40 years, weight of body 150 kg.; severe dyspnœa on walking. Examination showed transposition of the lungs over the heart; bruit de rapelle. Pressure in the radial artery 190 mm. Hg.

bruit de rapelle. This irregularity sometimes depends upon the high tension under which the heart is acting (this is confirmed by well-known experiments on animals) and may disappear spontaneously with the diminution of pressure. But atropine often aids materially in securing uniformity of the heart's action. The arhythmia does not disappear at once but gradually. As a general thing, the type first changes, the complete irregularity is converted into allorhythmia, *i.e.*, a form of arhythmia which occurs with a certain degree of regularity (bigemini, trigemini). The most important factor in judging the form of arhythmia is not so much the rhythm of the pulse, *i.e.*, the varying duration of the individual beats and the varying intervals between them, but rather the variability in the strength of the different beats. On the whole, this can be detected very well with the finger, although a better insight is afforded by measurement of the blood-pressure with the sphygmomanometer. This informs us concerning the differences of arterial pressure during the periods of the larger and smaller pulse beats. Hence the measurement is a much more certain gauge than the finger of the degree of arhythmia. The greater the difference between the maximum and minimum pressure, as shown by the instrument, the greater is the arhythmia and its injurious influence. Sphygmomanometric measurement will show that the differences between the maximum and minimum become less, despite the persistence of arhythmia, and this is a distinct indication that the latter has improved despite its persistence. This is found not infrequently after the use of atropine and also when the drug is combined with digitalis. The difference is reduced to a minimum, so that the pulse merely remains irregular, and even the irregularity may disappear. I may here remark that intermissions of the pulse resist treatment more obstinately than arhythmia. However, many cases are found in which the latter symptom also resists every plan of treatment.

I am not in the habit of giving digitalis in such cases or, at least, only when an exacerbation occurs, attended with lowering of the blood-pressure. I have sometimes tried sodium iodide, according to Huchard's recommendation. No striking diminution of arterial tension was observed after the administration of this remedy. It is well tolerated even after pro-

longed use and appears to diminish the tendency to dyspnœa in certain cases.

What are the principles according to which those cases, in which the dyspnœa is attended with weak heart's action, are to be treated? Undoubtedly the chief object of treatment must be to remove the cardiac weakness as far as possible. The treatment of the individual case must therefore be preceded by the consideration of the factors to which the development of the cardiac weakness may be attributed.

The occurrence of weak heart in obese individuals is explained very easily because it is evident that the general nutritive disturbance must also affect the heart muscle, and may thus give rise to fatty degeneration and weakness of the heart. Due attention must therefore be paid to the general disturbance of nutrition in these cases, as well as in those in which obesity is attended with high arterial tension. The consumption of fat offers the possibility of the disappearance of the adipose tissue situated upon the heart and between its muscular fibres. The reduction of weight acts favorably by diminishing the muscular effort necessary to raise the body, and also diminishes the dyspnœal irritants produced by muscular effort.

The same rules hold good here as formerly in the treatment of obesity, except that bodily exercise possesses even greater importance. Here the exercise not alone increases the consumption of fat, but also effects another important object, viz., thorough filling of the left heart. the arteries and capillaries of the greater circulation.

In conditions of heart weakness, the distribution of blood is gradually changed, so that the veins are filled more abundantly at the cost of the arteries and capillaries. Inasmuch as the vis a tergo of the feeble left ventricle is slight, the blood flows slowly from the dilated veins into the right ventricle, and the latter does not fill the pulmonary vessels under high pressure unless the pressure in the left auricle has increased on account of the accumulation of blood which the left ventricle could not expel into the arteries. So long as the blood flows from the pulmonary vessels into the left auricle without any material obstruction, it may be assumed that dyspnœa will not occur. This will only develop when, as the result of increasing pressure in the left auricle, the capillaries of the

pulmonary alveoli are brought under greater tension. The increasing pressure in the left auricle is the direct result of the insufficiency of the feeble heart, but this is only manifested distinctly when the heart is called upon to do increased work which it cannot meet completely, *i.e.*, when the heart must evacuate its contents under great resistance. This is particularly true of the left ventricle because this is first subjected to the influence of the variations in resistance which are so apt to occur in the greater circulation. Such variations act only in an indirect manner upon the right heart.

If bodily exercise is increased to such an extent that strong stimuli (which do not, however, exceed physiological limits) are produced, then these stimuli induce more powerful or deeper respiratory movements. The latter offer favorable conditions for the accelerated flow of blood from the veins toward the thorax, for greater distention of the arteries and capillaries of the body and, what is very important, for the greater fulness of the nutrient arteries of the heart. As a matter of course, the increased fulness of the heart may only be permitted to proceed to the extent to which the heart is still capable of accommodation. The over-stepping of this limit is manifested at once by severe dyspnœa.

Favorable as is the increased fulness of the heart, with the associated increased action and increased passage of blood through its coronary arteries, its over-distention is equally injurious. Over-distention of an insufficient heart must give rise to dyspnœa because the organ is incapable of the work which is necessary to throw into the greater circulation the blood that has entered the thoracic organs as the result of the deep inspirations.

In the cases which are now under consideration, the therapeutic rule may be established that movement of the body should only be permitted to that extent at which the necessity arises for breathing more deeply and rapidly. Even at this point there is certainly an increase of the arterial pressure, but it is merely an expression of moderate distention of the left ventricle and is therefore desirable from a therapeutic standpoint.

Regular evacuations from the bowels must be secured for several reasons. In the first place, because the full intestines impede the action of the diaphragm, then because the prolonged

retention of fæcal masses in the intestines favors the plethoric condition in which the gut is usually found and which leads to varicosities in the hemorrhoidal plexus, and finally because accumulation of fæces in the cæcum is very apt to produce compression of the ascending vena cava. We need not discuss the unfavorable effects of such compression.

Necessary as it is to secure regular evacuations from the bowels, purgation is inadvisable or even injurious, inasmuch as it may give rise to conditions of weakness, lipothymia or even syncope. It may happen that the patients, who feel weaker as the result of the purgation, state that breathing has become easier, but this relief seems to me to be purchased too dearly. We must here look to the improvement of the patient's nutrition and must administer wine; the meals should be abundant and frequently repeated. The internal administration of iron usually is very beneficial, and the favorable results of the systematic use of waters containing Glauber's salt and, at the same time, a good deal of iron, are thus explained.

Under such treatment a favorable result is often obtained in quite a short time, and careful observation shows that the circulatory conditions have improved with the respiration. The patient informs us concerning the improvement in respiration; the improvement in the circulatory conditions is learned by measurement, which shows that the blood-pressure is increased.

If necessary, atropine or digitalis with and without atropine must be tried in such cases. At all events there is no contra-indication to their use.

Heart failure and hence a disposition to dyspnœa may develop, independent of general obesity, after severe infectious diseases, such as typhoid fever and diphtheria. Another and one of the most important causes of heart failure is overdistention of the heart as the result of strain.

In the last case it seems to be indicated to avoid everything that might produce dyspnœa and to do everything that offers the possibility of improving the lowered heart tonus. For the first reason, absolute rest is indicated; for the latter reason, cardiac tonics should be tried. Among these digitalis occupies the front rank. Da Costa recommended atropine and aconite. I have obtained good results from digitalis com-

bined with belladonna, but have not been in a position hitherto to try atropine alone or in combination with digitalis in such cases.

The treatment of heart failure after typhoid fever and diphtheria and the treatment of the resulting dyspnœa must be directed chiefly to the relief of the general condition of nutrition. Cardiac remedies proper may be dispensed with; we should employ stimulants and tonics, such as alcohol, coffee, iron, if necessary nux vomica.

If dyspnœa is present in mitral insufficiency, with or without stenosis, and if the arterial pressure is also found to be very low, then the question arises with regard to treatment, whether the intensity of the valvular lesion as such or the weakness which attacks a heart suffering from a slight valvular lesion, is to be regarded as the cause of the dyspnœa. A decision is extremely difficult because, as reflection will show, the results of a severe valvular lesion with a sufficient heart muscle may be similar to those observed after slight valvular lesion with insufficient heart muscle.

The first assumption seems to render all treatment useless from the start, so that we must always be guided by the latter assumption. From this standpoint the treatment must follow the principles which I have already laid down with regard to cardiac insufficiency. We must endeavor, by suitable diet, regulation of the secretions and excretions, light exercise (adapted to each individual case), to change the distribution of blood in favor of the arteries and capillaries, and to exercise a favorable influence on the fulness of the heart and, with it, on the nutrition of the organ. Such a change will facilitate, to a certain extent, the escape of blood from the lungs (which is already obstructed by the valvular lesion) and this will improve the expansile or respiratory capacity of the lungs.

Experience teaches that this process is influenced favorably by heart tonics and hence their use appears indicated under certain circumstances. Apart from digitalis with atropine I have seen good results from infusion of adonis (4:150).

It goes without saying that improvement of the heart lesion itself cannot be expected; the most favorable result will be the restitution of the status quo ante.

When a favorable effect is produced, it may be inferred *a posteriori* that the circulatory disturbances resulting from the

valvular lesion as such have not been very pronounced. If the treatment is useless, it may be assumed either that the anatomical changes which gave rise to the heart failure had progressed so far that restitution of the function of the muscle was impossible, or the valvular lesion is so pronounced that a change in the muscular action of the heart cannot counteract the injury resulting from the valvular lesion.

Before passing to the treatment of cardiac asthma, I will report a few cases of cardiac dyspnœa from my practice.

IX. Cases of Cardiac Dyspnœa.

I. Mr. E., æt. 51 years; obese for last ten years, respiratory disturbances during past year. Also tendency to palpitation on making an ascent and on mental excitement. Hemorrhoidal hemorrhages. Heart apparently normal in size, sounds clear. May 14th, 1886, pt. weighed 144 kg. Pressure of radial artery 110 mm. Hg. Slight amount of albumin in urine. Treatment: Marienbad cure, exercise, baths, reducing diet. May 21st, weight of body 139 kg. 80 dg., arterial pressure 135. May 28th, weight 135 kg., arterial pressure 145. Respiration much easier, can climb quite well. June 16th, weight 129 kg. 24 dg., arterial pressure 130. Only a trace of albumin found. Striking improvement, which continued during the winter of 1887; during this time the diet was continued and the patient lost 9 kg. in weight. May 23d, 1887, weight 124 kg. 40 dg., arterial pressure 155. Breathing very much improved, no palpitation. Repetition of the cure for prophylactic reasons and in order to effect a further reduction in weight. Diagnosis: beginning insufficiency of the heart and passive congestion of the kidneys. Both relieved by treatment.

II. Mr. B., æt. 55 years. Complains of difficulty of breathing and palpitation, on simply lying down or on movement. Heart sounds normal. Enlargement of the heart not demontrable. June 5th, 1885, arterial pressure 190 mm. Hg., considerable albumin in urine. June 24th, arterial pressure 160; respiration much better, no palpitation, albumin unchanged Diagnosis: arterio-sclerosis, albuminuria. The dyspnœa improves and palpitation disappears, attended with lowering of blood-pressure. Treatment: mineral water cure in Marienbad

III. Mr. M., æt. 65 years. Complains of difficulty in breathing and cough. Examination on June 5th: extensive râles over both lungs, pulse arhythmical; maximum arterial pressure 195, minimum 170. Treament: digitalis with belladonna, in addition to mild mineral water cure. June 21st, arhythmia disappeared, breathing better, production of mucus in the lungs less, only a few râles. Digitalis and belladonna dis-

continued. June 26th, arhythmia has reappeared, but less marked; maximum pressure 170, minimum 165; breathing constantly better. Diagnosis: arterio-sclerosis with corresponding degeneration of the heart. The arterial pressure diminished, the dyspnœa disappeared, and the stasis catarrh in the lungs improved. The improvement of the arhythmia was shown by the slight difference between the maximum and minimum of arterial pressure.

IV. Mr. T., æt. 39 years. Complains of palpitation after excitement, also spontaneously in the middle of the night. Dyspnœa on ascending. Patient is an inveterate smoker. Heart normal. June 14th, 1886, arterial pressure 123. Treatment: mild mineral water cure, cold rubbings. June 27th, arterial pressure 132. No palpitation; breathing better. July 2d, patient, who had been doing well, again complained of severe palpitation, which is more frequent at night and is associated with a feeling of anxiety. Arterial pressure 120. It appears that the patient has taken too violent exercise and he is therefore directed to exercise less. July 6th, the patient, who has obeyed orders, is doing better. Arterial pressure 118. July 13th, feels entirely well, arterial pressure 124, palpitation and respiratory disturbances are regarded as the toxic after-effects of nicotine. The case shows the injurious effect of forced movements. The lowering of the blood-pressure is to be attributed to exhaustion of the heart, perhaps associated with temporary dilatation. The results of the strain disappeared during comparative rest and pari passu with their disappearance the arterial pressure again increased.

V. Mrs. W. æt. 52 years; complains of dyspnœa, also coprostasis with dyspeptic symptoms. Urinary secretion said to be small. Heart's action very arhythmical. Heart sounds clear, heart tender on pressure. Treatment: moderate mineral water cure. July 13th, 1886, maximum arterial pressure 135, minimum 100. Tinct. digit. c. tinct. belladon. āā. July 22d, respiration better, urine more abundant; pressure, maximum 115, minimum 100. July 28th, pulse more uniform, average pressure 120, still arhythmia. Aug. 3d, pulsus bigeminus instead of arhythmia, breathing much better, radial pressure 122. Aug. 9th, radial pressure 120, heart much less sensitive on pressure. Diagnosis: chronic myocarditis (?). Favorable effect of digitalis and belladonna is manifested by abolition of difference between maximum and minimum of pressure; at the same time breathing became easier and the urine more abundant.

VI. Mr. K., æt. 57 years. In 1884 patient had taken a cure at Marienbad for chronic catarrh of stomach and intestines with good effect; reduced his weight 1 kg.; in 1885, repeated the cure. In 1886 he returned but complained more of difficulty in breathing. Also stated that he urinated a larger

amount than before and that the desire to urinate appeared particularly on walking up-stairs. July 19th, nothing abnormal found in the heart, urine contained small amount of albumin. July 25th, pressure 155, pulse occasionally intermittent, same condition. July 27th, pressure 160, breathing better. Aug. 3d, pressure 122 (measured in the morning); auscultation shows reduplication of the first sound. Aug. 10th, patient had great trouble in breathing during the night and passed large amount of urine. Infus. digital. 0.5–150, tinct. belladon. 1.0. Aug. 11th, pressure 160, respiration improved. Aug. 13th, pressure 150, situation unchanged, no dyspnœa. Aug. 15th, pressure 100, feels weak, but breathing is free. Aug. 16th, pressure 110, feels better, the intermissions of pulse have disappeared. Aug. 18th, pressure 140, condition unchanged. Aug. 19th, pressure 145, condition unchanged. The probable diagnosis appeared to be beginning cirrhosis of the kidneys. It is noteworthy that the functional disturbance of the heart was probably aggravated by unusual walking. This opinion was corroborated by the occurrence of reduplication of the heart sounds and the increased dyspnœa. Digitalis acted favorably; it was followed immediately by temporary increase of pressure, then by considerable diminution of pressure, and then the pressure returned to its original height. It is also noteworthy that an increase of the urinary secretion coincided with increased dyspnœa.

VII. Mr. R., æt. 45 years, complains of difficulty in breathing; moderate degree of obesity, reduplication of systolic sound. Aug. 21st, pressure 180. Aug. 27th, pressure 170. Sept. 10th, pressure 160, no reduplication of heart sounds. Diagnosis: arterio-sclerosis. It is noteworthy that the reduplication disappeared with diminishing pressure.

VIII. Mrs. R., æt. 42 years, marked obesity with dyspnœa. June 1st, pressure 110. Aug. 20th, pressure 95. Diagnosis: fatty heart. Breathing improved materially despite the diminution of pressure during the course of treatment.

IX. Mr. H., æt. 40 years, carpenter, complains of great difficulty in breathing; said to have had left-sided pleurisy two months before. Heart enlarged toward the right and left sides. Systole and diastole accompanied by a grating resonant sound. Dec. 15th, 1886, temporal pressure 100. Dec. 17th, condition unchanged, also complains of feeling of constriction in chest. Temporal pressure 65. Infus. digital. 0.5–150, sol. atropine (0.3%) 1.0. Dec. 30th, dyspnœa better, only a diastolic murmur over heart and aorta. Pressure 60. Respiration better. June 8th, 1887, has felt comparatively well while resting at home. The walk to the Policlinic causes violent dyspnœa with pain in the heart and palpitation. Pressure 70. Jan. 14th, walks better, can stand the walk to the Policlinic. Pressure 80. Jan. 20th, progressive improvement during com-

parative rest, palpitation and dyspnœa on the slightest work; moderate movement tolerated fairly. Infus. digit. 1–150, sol. atropine (0.3%) 1.0. Feb. 7th, patient begins to do light carpenter work which he tolerates. Feb. 11th, progressive improvement, can work longer and do somewhat heavier work. Feb. 15th, as an experiment the patient receives digitalis alone, without atropine. Mar. 5th, condition unchanged, except that patient states that palpitation occurs more readily during work than while taking the former medicine. Digitalis with atropine is again administered. Mar. 8th, patient states that he can work better than before. Temporal pressure 80. Mar. 19th, patient can work during the morning, but after lunch suffers from gastric disturbance and is apt to get palpitation while working. Pressure 80. Mar. 31st, digitalis discontinued for past 5 days; condition unchanged, pressure 62. April 4th, condition unchanged, adonis with atropine. April 9th, pressure 60, condition unchanged. Thus, from Dec. 17th, 1886, to Feb. 15th, 1887, digitalis with atropine was well tolerated, and progressive though slow improvement occurred after its use. The improvement was especially noticeable from Feb. 5th–7th, when the strong infusion was used. The experiment made between Feb. 15th and Mar. 8th favors the belief that digitalis alone acts less favorably than digitalis with atropine. On the whole, higher pressure was found on the most comfortable days. (The first measurement is not decisive because the patients, as a rule, are excited.) Digitalis was discontinued on account of gastric disturbances and adonis was tried. The arterial pressure then fell, but breathing was not made materially worse. Diagnosis: aortic insufficiency (also pericarditis in the beginning).

X. Mr. B., æt. 38 years, baker. Complains of great difficulty in breathing and palpitation. Heart enlarged in length and breath. Loud diastolic murmur over right heart and aorta. Arhythmia, distinct capillary pulse. Temporal pressure 80. Dec. 20th, treatment: atropine. Dec. 28th, palpitation improved, breathing still difficult. Pressure 92. Arhythmia unchanged. Jan. 20th, palpitation and breathing improved, arhythmia less. Pressure 90. Jan. 27th, condition unchanged, pressure 100. Feb. 19th, exacerbation, severe dyspnœa, cervical veins swollen and pulsating. Pressure 60. Treatment: digitalis 0.5–150 with atropine. Feb. 21st, condition unchanged, pressure 80. Digitalis 1–150 with atropine. Feb. 26th, decided improvement, pressure 87. Mar. 5th, improvement continues, pressure 85. Mar. 19th, material relief, breathing entirely free, pressure 100. Mar. 23d, patient attempts to discontinue the medicine occasionally, but after several days feels the need of resuming it. Diagnosis: aortic insufficiency. It is noteworthy that brief improvement was obtained from atropine and that the exacerbation on Feb.

19th was attended with diminished arterial and increased venous pressure.

IX. Mrs. C., æt. 36 years. Complains of severe dyspnœa, on walking and lying down. Face swollen, also feet. Albumin in urine, which is scanty. Distinct pulsation of jugular vein. Heart's action arhythmical. First heart sound rings like a tense string, cardiac dulness increased to the right. Mar. 7th, temporal pressure 60. Treatment: digitalis with atropine. Mar. 9th, breathing much easier, can lie down, urine more abundant, face no longer swollen, œdema diminishing. Pressure 80. Mar. 13th, improvement continues, œdema disappeared, no albumin in urine. A distinct systolic murmur heard instead of the ringing first sound. Cervical veins no longer distended. Mar. 26th, breathing good, anorexia, digitalis discontinued. April 4th, dypsnœa returns, digitalis resumed. April 12th, no improvement. Temporal pressure 60. Adonis is tried. Diagnosis: mitral insufficiency. Digitalis with atropine had brilliant effects for a short time. A second trial fails. Corresponding with the bad result there was no increase of pressure, which was distinctly noticeable at the first trial.

XII. Mr. D., æt. 44 years, complains of dyspnœa on lying down and is therefore unable to sleep. Diastolic murmur over the aorta, capillary pulse. April 4th, the patient is directed to lie down and the temporal pressure and the boundary between the lungs and liver measured at once. Dyspnœa develops at the end of a minute and the boundary of the lung is found to be pushed downward about 1.5 cm. The arterial pressure had increased from 130 to 170. Treatment: tinct. lobelia with atropine. April 9th, decided improvement, patient can lie down without dyspnœa. April 15th, patient took the medicine until the 12th, felt well until the 14th; then grew worse. Atropine resumed. April 16th, again distinct improvement. April 27th, improvement continues. Diagnosis: aortic insufficiency with high blood-pressure. Atropine with lobelia has good effects.

X. Treatment of Cardiac Asthma.

We will here discuss chiefly the treatment of the attack itself, because so far as regards the inter-paroxysmal period the same remarks hold good as in cardiac dyspnœa. We must carefully distinguish between the different categories which I have considered in the chapter on diagnosis.

The use of digitalis with atropine is indicated particularly in feeble and, at the same time, irregular heart's action, atropine alone and iodine preparations (potassium iodide or sodium iodide) in arterio-sclerosis. Sodium nitrate and nitroglycerin

usually prevent the occurrence of the asthmatic attack, especially when the asthma appears in the train of angina pectoris.

As regards the attack itself, the treatment has been hitherto tentative and by no means assured. Narcotics and stimulants are employed. Among the narcotics morphine is the one chiefly employed, in the form of subcutaneous injections, to abort the attack. Wine, alcohol, ether, camphor and coffee are recommended among the stimulants. There has been hitherto no strict indication for the one or the other, and I will now attempt to discuss the possibility of such an indication.

As regards morphine which, according to numerous statements, may relieve the attack, Traube has said that it acts favorably because it diminishes the irritability of the respiratory centre. A. Fraenkel has also accepted this opinion. If the morphine acted only in this way, its administration would, in my opinion, be strongly contraindicated, because the most important compensatory factor in dyspnœa consists in the activity of the respiratory centre.

The favorable action of morphine may be interpreted, however, in another way. It appears to me to be due to the fact that the drug exerts a material influence on the blood-pressure. Morphine causes lowering of the blood-pressure, as has been shown by experiments (Binz), and, at the same time, the venous pressure falls instead of rising. This would favor its administration in the prodromal stage, and we may assume that its favorable action is obtained chiefly when it is used in prodromal asthma.

So long as the blood-pressure is high and the pulse full and vigorous during the attack, morphine may be administered without fear. It is very possible that early artificial diminution of cardiac tension will prevent the heart from leaving its condition of equilibrium. This would also diminish the arterial tension, but under very unfavorable conditions. In other words, morphine, when administered in prodromal asthma, may possibly prevent the transition into asthma proper.

It is also possible that, in the spasmodic form of asthma which I have assumed, morphine acts favorably by relieving the cardiac spasm.

When we have to deal with the paretic form of asthma, morphine should not be used. According to theoretical considerations, stimulants are then indicated and their action is

understood perfectly well. It consists in the stimulation of the depressed heart's action.

Cold must be included among the stimulants. Under its action the tremulous peristaltic movement of the heart yields, as I know by experience, to a regular co-ordinated mode of contraction. Moreover the application of cold to the heart increases the blood-pressure considerably and permanently, as Silva showed.

In addition to narcotics and stimulants, the inhalation of nitrite of amyl has also been recommended. French writers (Peter, G. Sée) also extol the effects of application of blisters and dry cups.

If there is an abundant secretion of mucus, perhaps associated with œdema, expectorants which may be combined with the stimulants are administered, in accordance with long established custom.

I will now give a tabulated account of a number of cases of cardiac asthma, taken from my practice.

XI. CASES OF CARDIAC ASTHMA.

AGE.	SEX.	RESPIRATORY SYMPTOMS.	CARDIAC SYMPTOMS.	BLOOD PRESSURE.	REMARKS.
61	F.	Nocturnal attacks of dyspnœa. Feeling of anxiety.	Palpitation during dyspnœa.	8 7 r^1=120 10 7 r=116	Feeling of weakness in both arms during the attack. Increased diuresis after the attack. Marienbad.
49	F.	Diurnal attacks of dyspnœa. Cough and expectoration at times after the attacks.	During the attacks palpitation with feeling of acceleration of pulse and tremor of the heart. Distinct systolic murmur over aorta. Pronounced arteriosclerosis. Heart labile, with tendency to arhythmia.	10 7 r=185 23 7 r=160 28 7 r=140 4 8 r=158	Attacks more frequent in winter. Severe cold causes dyspnœa with cyanosis. Traces of albumin in urine. Arhythmia during transition from higher to lower pressure (July 23d, 30th). Pulse more regular after belladonna. Marienbad.
68	M.	Nocturnal attacks of orthopnœa with cough.	No palpitation. Arteriosclerosis.	r=180 r=160	During the attacks the blood pressure is higher than when the condition has improved. Tinct. lobel. with belladonna acts well. Marienbad. Permanent improvement noted after the lapse of 2 years.
44	M.	Nocturnal attacks of severe dyspnœa, during which râles develop in the chest. Expectoration of bloody sputum immediately after the attack or on the following morning	No palpitation. Heart findings normal during first year of observation. In the second year examination shows prolongation of second sound over aorta and capillary pulse. Insufficiency of the aorta.	1884 1 8 r=185 4 8 r=170 9 8 r=158 17/8 r=150 4 9 r=156 1885 28 7 r=180 4/8 r=165 11/8 r=140 18 8 r=158 22 8 r=150	Albumin in urine. No attacks during course of treatment, during which blood-pressure diminishes. Feels better the following winter. Attacks rare; bloody sputa no longer appear. Milk diet. Marienbad. No medicinal treatment.

^{1} r signifies the pressure in the radial artery, t that in the temporal artery.

58	M.	Attacks of dyspnœa at night during sleep.	Palpitation during attacks. Arhythmia, distinct pulsus bigeminus in interparoxysmal period.	18/7 r=150 23/7 r=120 26/7 r=110 5/8 r=130 12/8 r=120	The heart's action which was at first irregular, gradually improves while the blood pressure is diminishing. No attacks, no medicinal treatment. Marienbad.
36	F.	Diurnal and nocturnal attacks of dyspnœa, lasting a few minutes.	Palpitation after attacks, when breathing has become easy.	9/7 r= 78 17/7 r=110	Improvement, no attacks, no medicinal treatment. Marienbad.
56	F.	Diurnal and nocturnal attacks of dyspnœa. Distinct emphysema.	Palpitation during attacks.	1882 20/5 r=165 4/6 r=135 1883 20/5 r=145 6/6 r=130 21/6 r=118 27/6 r=145 4/7 r=150 1884 27/5 r=140 30/6 r=115	In addition to the asthmatic seizures, attacks of rush of blood to the head with dizziness. Striking improvement after first course of treatment. Marienbad. Improvement continues in following years.
53	M.	Diurnal attacks of dyspnœa after slightest movement. Spontaneous attacks at night. The attacks terminate with cough and expectoration.	Palpitation apt to occur on lying down. Cardiac dulness enlarged to the right. Second pulmonary sound accentuated.	28/6 r=140 16/7 r=130	Striking improvement. Marienbad. No medicinal treatment.

CASES OF CARDIAC ASTHMA.—CONTINUED.

AGE.	SEX.	RESPIRATORY SYMPTOMS.	CARDIAC SYMPTOMS.	BLOOD PRESSURE.	REMARKS.
49	F	Nocturnal attacks during sleep. Severe dyspnœa.	Pain in the heart during attacks.	21/6 r=155 31/7 r=170	Rush of blood to the head during attacks, face becomes cyanotic and dark patches appear on face. Traces of albumin in urine. The high pressure (170) was observed during severe dyspnœa after rapid walking. Improvement. Albumin disappears. Marienbad. No medicinal treatment.
56	M.	Very severe attacks of dyspnœa lasting ½ hour. Râles in lungs during attack.	No cardiac symptoms.	r=175	Cold sweat on forehead during attack, micturition and defecation at end of attack. Improvement in first year (1882). Marienbad. No medicinal treatment. In 1883 and 1884 patient visited Marienbad, but did not consult a physician; died in 1886.
32	M.	Nocturnal attacks of violent dyspnœa.	Emphysema.	r=148	Patient checks attacks by running around room until he perspires. Marienbad. No medicinal treatment. Improvement.
42	M.	Nocturnal attacks after which bloody sputum is expectorated.	Rhythm du galop.	27/5 r=180–190 2/6 r=185-200 6/6 r=165–170 8/7 r=185–190	May 25th to June 7th patient continued digitalis which he had taken before. On account of arhythmia, shown by great difference between maximum and minimum of blood-pressure, digitalis is replaced by atropine. Pressure then becomes uniform and arhythmia disappears. No attacks during treatment.

50	F.	Diurnal attacks of dyspnœa with syncope.	Sensation of trembling of heart during attacks.	1/8 r=130 4/8 r=160 15 minutes later 180	Measurement on Aug. 4th made during attack. The already increased pressure quickly rose to 185. Marienbad. No medicinal treatment.
40	F.	Nocturnal attacks of severe dyspnœa, followed by bloody, frothy expectoration.	Aortic insufficiency.	2/7 r=165 8/7 r=158	Marienbad. No medicinal treatment.
32	F.	Diurnal attacks of dyspnœa.	Heart dilated on the right; reduplication of systolic sound.	9/8 r=152 11/8 r=118	The measurement on Aug. 11th was made during an attack. Unlike other cases, the pressure fell during the attack. No medicinal treatment.
38	F.	Attacks of dyspnœa lasting hours, during which fine and coarse rhonchi develop in chest.	Severe palpitation during attacks, but heart's action does not appear to be increased.	r=118	Cold compresses in cardiac region during the seizures have a good effect. Palpitation is relieved and dyspnœa is lessened. Attacks occur during and after menstruation. Marienbad. Cold compresses. Improvement.
49	F.	Attacks of dyspnœa during the day.	Severe palpitation during attacks.	30/7 r=168 12/8 r=158	Rush of blood and a feeling as if the blood would shoot suddenly into the head during attacks. In addition to palpitation, sensation of pulsation in neck in carotid region. Marienbad. No medicinal treatment.

CASES OF CARDIAC ASTHMA.—*Continued.*

AGE.	SEX.	RESPIRATORY SYMPTOMS.	CARDIAC SYMPTOMS.	BLOOD PRESSURE.	REMARKS.
72	M.	Constant severe dyspnœa; two violent attacks of asthma observed, each lasting 2–3 hours.	Arteriosclerosis.	r =170	Distinct œdema of lungs during attack, dulness and crepitant rales. Heart sounds muffled, pulse small. Measurement not made during attack. Quebracho useless against the chronic dyspnœa. Stimulants, champagne, infus. ipecac, with liq. ammon. anisat. during attack.
34	M.	Nocturnal attacks, on waking suddenly from deep sleep.	Palpitation during attacks.	16/7 r=120 10/8 r=126	Marienbad. No medicinal treatment. Improvement.
52	M.	Attacks of orthopnœa at night, lasting hours.	At first visits reduplication of both sounds over left ventricle and slight systolic murmur. Ten days later reduplication disappeared and only the murmur heard.	29/6 r=180 5/7 r=162 8/7 r=180 12/7 r=180	Mild whey cure. Belladonna. Condition unchanged.
52	M.	Attacks of dyspnœa on lying down.	Arhythmia.	20/6 r=165 30/6 r=155 16/7 r=150	Arhythmia disappears in short time, also the attacks. Marienbad. No medicinal treatment. Improvement continues. Fair condition during following winter.
64	M.	Nocturnal attacks of dyspnœa, especially on lying on right side. Attacks in daytime after excitement.	Mitral insufficiency. Diurnal attacks associated with palpitation.	8/7 r=130 8/7 r=120	Tendency to vertigo and dizziness. Marienbad. No medicinal treatment.

57	F.	Nocturnal attacks, lasting several hours.	Aortic insufficiency. Attack begins with pain in cardiac region, then palpitation, then dyspnœa.	17/4 t=140 22/11 t=135 29/11 t=135	Policlinic. Atropine acts favorably. Attacks disappear, only palpitation remains. Nitro-glycerin used successfully against latter.
48	F.	Nocturnal attacks.	Mitral insufficiency; palpitation during attacks.	t=100	Policlinic. Atropine relieves the attacks and acts favorably on the heart's action. Improvement continues.
50	M.	Dyspnœa and feeling of anxiety on lying down.	Palpitation, rhythm du galop.	21/4 t=110 23/4 t= 90	Policlinic. Cannot fall asleep because dyspnœa then develops at once: Tinct. lobel. and atropine. April 23d. dyspnœa disappears during sleep. Improvement continues.
30	M.	Attack of violent dyspnœa, lasting several hours. Attacks in daytime.	Sensation of cardiac spasm during seizures.	14/4 t=110	Pallor of face. Abundant expectoration of mucus mixed with blood after attack. Relief from cold compresses. Lobelia and atropine.
42	M.	Nocturnal attacks of asthma, also after eating. Duration 2–3 hours.	Palpitation.	16/3 t=120	Atropine alone, nitro-glycerin and sodium iodide without effect. Attacks disappear after digitalis with atropine.

THE

INFLUENCE OF MENSTRUATION

AND OF

PATHOLOGICAL CONDITIONS OF THE UTERUS ON CUTANEOUS DISEASES

BY

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THE

INFLUENCE OF MENSTRUATION

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During the fifteen years in which I have practised at Vichy, I have frequently been struck by the evident sympathy which exists between the utero-ovarian and tegumentary systems. This is a subject little known and little investigated. It has seemed to me that it would be of some interest to condense within a few pages my personal observations and the notes which I have been able to collect in various authorities.

I shall study at first the influence of menstruation and, after having examined the relation between uterine and cutaneous pathology, I will conclude with certain considerations regarding etiology and therapeutics.

I.

Every one recognizes the coincidence of acne eruptions with puberty and the menopause. Young girls become "pimply," as the common expression runs, when the functions of ovulation are slow in becoming established or are irregular. Similarly circulatory disturbances attend the troublesome period of the fourth decade when menstruation is about to cease. In the interval that local asphyxia, that transient vascular affection, attended by variation in color, occurs much less frequently or it appears to follow delayed menses, uterine troubles, constipation, dyspepsia, and every other affection that may depend on the same constitutional condition. The cheeks

and region around the mouth are most frequently affected; pustules may predominate, and may cause faces formerly striking to assume an appearance almost repulsive. The public, rarely considerate, knowing that alcoholism prevails in all classes of society, do not fail to suspect the sobriety of such patients, who, on the contrary, often refrain from drinking and eating, or at least take only wine and water and eat lightly, with the quite reasonable hope that they may be able to remedy what they regard as a real infirmity. It is comprehensible that this forms a grave matter for consideration with many women who regard their reputation as highly as they do their health. And they are right, for not only may the ducts of the sebaceous follicles become greatly enlarged, but the subcutaneous connective tissue may share in this enlargement, and may lead to an hypertrophy of the end or alæ of the nose. I published formerly (Gazette Obstétricale, April 20th, 1878) the case of a young lady of twenty-five, who, at almost every menstrual period, had bloating of the face which bore an exact resemblance to erysipelas. I said that it resembled erysipelas, in order to avoid a more exact description; but the term "menstrual erysipelas" has been applied to similar swellings. In his thesis (published April 1st, 1886), M. Tourneux believes that menstruation causes various cutaneous eruptions which serve as a nidus for a supposed streptococcus. In order to explain the periodicity of the erysipelatous eruptions by reproduction, he admits, with Professor Verneuil, the permanence of the microbes of erysipelas at one point on the surface of the body. Hence there is no need of fresh infection at each menstrual period. The patients are auto-infectious; auto-inoculation occurs because the menstrual eruption causes solutions of continuity or excoriating dermatitis. Professor Hardy has applied the term "pemphigus of young girls" (pemphigus virginum) to a bullous eruption which is marked by successive eruptions extending over several months, and which appears only in young girls between fourteen and twenty, in whom menstruation has been interrupted. He has seen only four cases, two which he was unable to follow to their conclusion, and two in which cure resulted from the restoration of the menses.

According to M. Danlos's thesis ("Étude sur la Menstruation au point de vue de son influence sur les maladies cutanées,"

1874) eczema and acne show a preference for the face because of the unusual vascularity of this region.

These eruptions are rare when the periods become established without causing disturbance of the general economy. They usually precede the flow two or three days and fade when the uterine hemorrhage is established. In other cases, adds the distinguished physician of the Tenon hospital, "the menses continue to be suppressed and the eruption persists, as if the hidden trouble from which the system suffered was transferred to the exterior." "In patients with psoriasis, lichen or prurigo, sometimes before the periods the papules become redder and the itching and scratching more marked. However, the effect of the eruption when it occurs is much less appreciable in these dry affections than it is in the case of moist eruptions like eczema and impetigo.

"We have the mildest example of eruptions which develop simultaneously with the menses in herpes labialis, which in many women appears regularly at each period. In most women who are thus affected the herpes is confined to a few patches at the free border of the lips; but, sometimes it is more extensive and the herpetic patches are found also on the cheeks and the nose.

"We may compare with herpes labialis the exacerbation of a chronic pruritus vulvæ, the eruptions of herpes and eczema of the vulva which sometimes occur under the same conditions. Here it is the excessive congestion of the utero-ovarian system which seems to be the cause of the localization.

"In connection with this benign transient affection, let us refer again to the ephelides, following Alibert: 'The ephelides,' he says, 'are often transient; we observe some which only remain on the skin for a half a day. There are women who are only troubled with ephelides at the approach of menstruation. This mobile characteristic is peculiar to skins that are white and of a very fine texture.'"

M. Danlos admits a third variety of eruptions following the cessation of the menses and appearing after the corresponding periods. This would be a phenomenon comparable to that of menstrual disturbances. To support this statement he simply quotes from Jacquemier: "who has noted in his book on obstetrics the very remarkable fact of fluctuating sanguineous tumors developing periodically on the thighs and

in the pelvis. Courty has observed a similar occurrence. M. Potain, in his article on amenorrhœa, after having referred to periodical hemorrhages in women who do not menstruate, adds that the congestion, which in this instance leads to hemorrhage, and which at other times ceases spontaneously, may cause various acute affections, such as erysipelas, urticaria, furuncles, pemphigus, and other cutaneous eruptions, but he makes no mention of the periodic nature of these eruptions."

"M. Hardy considers suppression of the menses as one of the most frequent causes of erythema nodosum. Grisolle expresses the same opinion. Alibert has seen zona develop under the same conditions. It may be asked in this case if this is not a mere coincidence and if it is necessary to see a relation of cause and effect between these eruptions and the absence of the menses. If the periodic character is wanting, it is difficult to decide. If the suppression is temporary, it is conceivable that the development of painful affections, like zona and erythema nodosum, produce a disturbance sufficient to arrest the ovarian menses, and if the suppression is of long duration, it is as simple to refer the absence of the menses to the chloro-anæmia and erythema nodosum to a lymphatic temperament as to make the eruption dependent upon the menstrual suppression.

"This is more readily appreciable when the outbreak of the eruption follows closely the sudden disappearance of the menses. In the following observation, quoted from Alibert, it is impossible to deny this relation: 'A young lady, aged twenty-four, was attacked with a general scaly eruption following suppression of the menses caused by fright. At the end of eight months the uterine functions became re-established and the affection disappeared, not to return.'

"The pruritus vulvæ is above all a complication of the menopause; it is often accompanied by vulvar eczema and intertrigo. In most cases we may refer it to the suppression of the flow, since its onset coincides with the disturbance of menstruation."

"Sometimes," as Franck says, "the bloody secretion is replaced by a muco-lymphatic or by an impetiginous eruption, attended, especially at night, with itching that disturbs slumber and almost defies relief."

In an article, published in the "Concours Médical" for April

14th, 1888, Dr. Deligny mentions various observations on hyperidrosis or profuse sweating, usually confined to a single region of the body, especially the face. He has observed two cases at puberty, though this is peculiar to the menopause. I cannot avoid quoting from this study.

"When profuse sweating," he says, "occurs in certain regions, as the breast, the axillæ, the waist, or the thighs, it often give rise to simple erythema which disappears on slight treatment. Beside the eczema and hyperidrosis, we often observe, at the time of the menopause, the development of eczema in different regions of the body, which appears for the first time, or rather is a recurrence of the same affection which already existed several years before. This is especially noticeable in the case of those suffering from joint affections; we have seen such patients in whom the eczema had presented itself for the first time when the menses were established and the second time at the menopause. The influence of these two physiological revolutions is undoubted.

"Eczema may frequently appear on the ears, or the scalp, the face, or the feet, but eczema genitalium is almost peculiar to the critical period. It begins on the labia majora and extends to the neighboring parts; in one case we observed the eczema occupying the inner sides of the thighs, the perineum, and half of the abdomen.

"This eczema is very annoying by reason of the very intense itching that accompanies it, with evening exacerbations; some patients have attacks that are really terrible. This is not true pruritus, but itching which is no less distressing. It may be added that eczema often succeeds pruritus. Pruritus and the consequent scratching often cause hypertrophy of the pigment at the time of puberty and the menopause. This pigmentation is most frequent on the genitals as a result of idiopathic pruritus, without cutaneous lesions; it is due to marked and oft-repeated hyperæmia of the capillaries. Eczema of the genitals is also frequently followed by temporary pigmentation.

"Rayer, Leroy de Méricourt, Grisolle, and Brière de Boismont have noted peculiar cases of blackish or bluish coloration appearing in cases of sudden establishment of the menopause. Bairé cites a case of Dr. Lyons, of Dublin ('Gazette des Hôpitaux,' 1858), in which the patient was a woman, aged fifty-

seven, whose menses had ceased two years before. She presented a discoloration of the entire skin, most marked on the hands, toes, and thighs. She soiled her linen and was obliged to bathe herself more than twenty times a day. Dr. Lyons attributes these phenomena to an excretion of pigment, due to an effort of nature to continue the elimination from the system. This case of chromidrosis resembles those of Billard, Bousquet, Neligan, Erasmus Wilson, Hardy, and Leroy de Méricourt."

Various eruptions then mark the critical period and accompany the flushing, vertigo, and circulatory troubles of every sort which afflict women between the ages of forty and fifty. Those who have varices see them enlarge, rupture, and ulcerate. If they tend to stoutness and have soft flesh, pseudolipomata may develop, especially in the neighborhood of the clavicle. A kind of chronic œdema occurs at this point, with a collection of lymphoid cells which reproduce. When the hyperplasia is situated in front of the clavicle, the projection may be sufficiently prominent to constitute a true deformity and to necessitate firm compression, to the exclusion of irritating ointments, tincture of iodine, and, above all, surgical interference.

The influence of the uterus upon the skin is especially manifest during gestation. The pigmentary aberrations then produced have long been familiar; the color and appearance of the face are greatly changed, and other parts of the body share in these changes.

Under the name *herpes gestationis* a peculiar eruption has been described which, according to Duhring, of Philadelphia, is only the vesicular variety of *dermatitis herpetiformis.* Toward the fifth or sixth month, pointed condylomata, of the cauliflower variety and very luxuriant, have been observed to develop on the vulva and to disappear after delivery. They may be venereal, but they are not specific or dangerous.

Syphilis itself, when it occurs simultaneously with pregnancy, may assume a very severe form. The flat syphilides, which must not be confounded with the vegetations above mentioned, present a papillary hypertrophy such that the tissues have a velvety appearance somewhat as they look under the microscope. There are several remarkable specimens in the museum of the hospital Saint-Louis.

II.

If the menstrual function has an action upon the skin, pathological conditions of the uterus exert an influence which is felt in quite another way. I will try to bring out this fact. In his clinical treatise on affections of the uterus (page 104), Martineau devotes a few pages to the study of spots, pigmentation, chromidrosis, herpes, eczema, etc., as resulting from the action of uterine troubles on the skin.

"These changes in the color of the skin which are met with," he says, "in the diseases of the womb and of the mammæ, are not the result of mere chance coincidences; they show that between these organs, physiologically separate, there really exists an affinity, a pathological intimacy.

If we observe that the chloasma persists until long after pregnancy, in fact for several years, we must suspect the presence of a uterine affection following delivery. Amenorrhœa, lactation, and menstrual irregularities have similar consequences, as has been duly established by numerous observations. The amount of pigment increases at each menstrual period, especially in summer.

Uterine affections may produce chloasma as marked as that of pregnancy. Accumulations of pigment at the points of election on the face, the mammary areola, the nymphæ, the linea alba, the anterior aspect of the trunk and the hair sometimes take place during the course of uterine affections in women who have presented none of these during their pregnancies. Long after the menopause (six years, for example) chloasma may appear simultaneously with the development of a tumor, whether ovarian or uterine.

"To the same class of phenomena belongs chromidrosis, which follows menstrual disturbances and uterine irritation. It attends lively emotions and other nervous or nutritive troubles. The close relation of these abnormal stains to uterine disorders is positively proved by treatment; cure the affection of the uterus and the spots will disappear simultaneously.

"In various skin diseases uterine disorders give rise to acute eruptions. Puberty, a period of sexual activity, and the menopause may even, by reason of the changes which they bring about in the system, cause these cutaneous troubles to be dependent upon them. We observe that the first menses

are accompanied by hemorrhages and cutaneous eruptions, which improve as the menstruation becomes less profuse and more regular, to suffer exacerbation if menstrual troubles persist. Observations show that when the uterus is imperfectly developed and the menses do not occur, eruptions of an intense and rebellious character appear at the probable time of puberty.

"The fact that herpes coincides with menstruation is a common notion. Courty, Raciborski, Jacquemier, and Potain affirm that the severity of the eruptions is proportioned to the dysmenorrhœa. Professor Potain lays especial stress upon lichen and prurigo. Eczemata and erysipelatous affections are not rare. The absent menses may be replaced by transient periodical eruptions."

Royer-Collard and other writers report cases of psoriasis, eczema, pemphigus, etc., which appear at the same time as the uterine affection and disappear with the latter, to return if the uterus is again diseased. In his "Traité de la Métrite chronique" (translated by Siefferman) Scanzoni affirms that "anæmic women, who have at the same time some affection of the genital organs, very often present various eruptions on the skin, especially when there occurs an intercurrent exacerbation of the uterine trouble. These are chronic eczema, acne disseminata and rosacea, erythematous eruptions, and transient urticariæ, as well as the furuncular diathesis, which is observed most frequently." Hebra also says: "Cases of seborrhœa and alopecia in chlorotic and leucophlegmatic women are due to the same cause as affections of the skin, acne and eczema, that occur in women who are sterile and subject to dysmenorrhœa, that is to a vicious state of the blood." We read in Moritz Kaposi's "Traduction des Maladies de la Peau" (page 377) that in women pruritus is often associated with sexual troubles, dysmenorrhœa, and the menopause. Pruritus of the genitals is often an early prodroma of cancer of the uterus.

Biett and Cazenave have claimed that we should seek for the most common cause of acne rosacea in affections of the stomach, the liver, or the uterus. Hardy affirms, in his "Traité des Maladies de la Peau" (1886, page 533), that these pathological conditions are so frequent without acne that we should only regard them as coincidences; however, he recognizes the

fact that pimples on the face occur more frequently in women than in the other sex, that they do not appear before puberty, and that the menopause, as it seemed to him, rather aggravated than produced the affection. Moreover, Hardy says (on page 739) that eczema of the female genitals often arises from a chronic leucorrhœal discharge. A true herpetic vaginitis may thus result, which differs from specific vaginitis in the intensity of the pruritus, the more serious character of the discharge, and the temporary exacerbation which usually accompanies the period of menstruation. On page 598 he admits the simultaneous occurrence of pruritus vulvæ and affections of the uterus and ovaries. "In certain women," he adds, "we observe redness, in fact a true erythematous eruption, extending over the vulva and the adjacent parts; in others we meet with certain superficial excoriations which are apparently eczematous. Pruritus vulvæ, existing independent of dartrous eruptions, venereal diseases, or vaginal discharges, is observed principally at the time of the menopause. Guibout ("Traité des Maladies de la Peau," page 272) affirms that the uterine congestion which precedes and accompanies each menstrual period impresses its marks upon the skin. "You will observe," he adds, "the same chloasma in chronic affections of the uterus, as in the case of fibromata, cancer, and in those profuse and persistent menorrhagiæ, unattended by any organic lesion, which characterize the menopause." As a result of contact with the irritating discharges from the uterus, there has also been observed (rarely, it is true) a leucoplasia with papillary granular projections which resemble the epithelial glossitis that has been roughly designated "psoriasis buccalis."

The prognosis of the lesion dependent upon a uterine trouble is quite grave, since epithelioma may result from it. This mode of termination constitutes an essential difference between it and diabetic eruptions which are associated with sugar in the urine. The latter, on the contrary, are cured by general and local treatment.

Whether chronic herpes of the genitals of menstrual origin is the same as recurrent venereal herpes progenitalis in man or not, it is certain that uterine or vaginal discharges, genital irritation, uncleanliness, and certain occupations (such as the use of the sewing-machine) seem to aid in its development.

The thesis of F. Bruneau ("Étude sur les éruptions herpétiques qui se font aux organes génitaux chez la femme" December 18th, 1880) is based on thirty-five cases of herpes genitalis observed at the Lourcine hospital. The author calls attention to the predominance of the eruption on the dependent points. When the cervix uteri was affected, "the posterior lip," he says, "quickly resumes its normal condition, but the anterior may remain ulcerated for a long time. This persistence of the ulceration at this point seems to us to be due to the contact of the stringy, viscous fluid, purulent or not, which escapes from the cervical cavity. The hypersecretion of the endometrium during herpetic eruptions is shown in many of our patients; it has seemed to us in some cases to be due to an extension of the vaginitis, or again, it has seemed as if a chronic leucorrhœa suddenly underwent a temporary exacerbation under the influence of the herpes." Again (page 43) he adds: "As a rule, the utero-ovarian system is not influenced by the discrete herpetic eruption; but it is no less certain that in women who have suffered from some internal trouble, such as ovaritis, metritis, perimetritis, or cervical catarrh, there occurs simultaneously with the cutaneous eruption marked hyperæsthesia of the hypogastric region. Perhaps the discrete herpetic eruption itself which appears on the skin is closely related to the affection of the internal genitals. In nearly all our patients an examination of the cervix revealed a chronic catarrh or ulceration of one of the lips, or else traces of former pelvic peritonitis; the leucorrhœa invariably increased simultaneously with the eruption, without, however, assuming the same profuseness as the uterine discharge which occurs in confluent herpes. How can we explain the phenomena just described? What is the reason of their correlation? What is their point of origin? Whether it is controlled by a general pathological condition or not, this appears to be necessarily dependent on the nervous system. Thus, acne of the face is situated by preference along the expansion of the trifacial which receives filaments from the sympathetic. Besides we are more and more disposed to assign the principal rôle to the nervous system in the production of the various dermopathies."

In his remarkable weekly lessons at the hospital Saint-Louis, Dr. Besnier has affirmed very categorically that sor-

row, the troubles of life, and strong emotions exert a certain action on acne, eczema, etc. It is evident that this influence is transmitted through the nervous system.

Dr. Henly has reported, in the "Annales de Dermatologie" (1886, page 350), several cases of psoriasis following fright or different emotions. Leloir has seen a polymorphous bullous erythema in a woman suddenly follow a violent attack of anger ("Des dermatoses par choc moral," 1887). Polymorphous erythema, which appears at certain seasons and especially in women who are debilitated or over-worked, is now regarded as an infectious disease, by auto-infection, not through germs introduced from without. Probably the central nervous system is first affected and the endocardium, especially in the neighborhood of the mitral valve, only undergoes, like the skin, a secondary shock. In the article "erythema" in the "Encyclopædic Dictionary of the Medical Sciences," Dr. Pignot affirms that the appearance of erythema, whether the cause be external or internal, implies more or less the intervention of the nerves that control the circulation in the skin. Nervous action, he adds, is more clearly manifest in the various erythemata which follow visceral lesions. Tooth-rashes in children are evidently of reflex origin. The same is true of the congestive swellings often observed on the face in women when they are the subjects of some utero-ovarian trouble, or even merely at the menstrual period. Moreover, in order to prove that the nervous system is in certain cases the primary, essential, and sole cause of erythematous lesions, he recalls the fact that the various neuralgiæ may cause reflex congestions that are more or less intense and extensive; such, for example, is the redness of the face seen during the painful attacks of trifacial neuralgia.

Purpura, which is not synonymous with hemorrhage, as is generally believed, is in its turn secondary to a disturbance of the vaso-motor centres. The posterior columns of the cord are the intermediate agents. Hence results a local congestion, accompanied by a transudation of the coloring matter of the blood or of a few globules; it is only exceptionally that a hemorrhage is added to this condition.

It is by reflex nervous action that Doctor Leonardi, in his interesting thesis (published January 17th, 1888) explains the appearance of varices in pregnant women. "Supported," he

says, "on this firm and unquestioned basis, the mind, grouping all the nervous phenomena which occur during pregnancy, can assign to their true origin the varices which then appear. And among the many and varied nervous phenomena of pregnancy, among the psychical troubles (such as longings, perversions, and vesaniæ), among the trophic disturbances (such as chloasma or pigmentation), the different reflex acts (as vomiting and ptyalism), and the manifestation of nervous and rheumatic diatheses, varix seems to us to be one of these phenomena due to the same cause as the others, of frequent occurrence, and evidently under the neuropathological influence."

In the Dechambre dictionary, under the word "Sympathy," L. Hecht states that "the irritability of the nervous system explains the frequent occurrence of morbid sympathetic phenomena in women of nervous temperament and delicate or enfeebled constitution, especially during the menstrual period; moreover, the sympathetic nervous phenomena that occur during the early months of pregnancy may be attributed to a weakening of the constitution, shown by the diminution in the number of the red blood-globules, and to the resulting irritation of the nervous system" (page 678). Again he adds: "The intensity of the morbid sympathetic phenomena does not bear any constant and necessary relation to that of the disease or of the symptoms to which they are due. This intensity may be equal to, or less than the latter. Here, again, the differences in the degree of irritability of the nervous system may explain the difference in the effects produced."

Moreover, it is rare that the patients, who present at once a pathological condition of the skin and of the generative organs, are not extremely nervous. These are most often women who may be classed under the head of arthritics, or those who bear an original taint, whose excretory organs act poorly, and who present great sensitiveness and an imperfect circulation. I am aware that less importance is now assigned to diatheses, or so called "cardinal diseases" than in the time of Bazin. The edifice of arthritis especially has been thrown down, and we only include under this head gout, with its chemical peculiarities, and rheumatism, with its special complications. We are more and more inclined to separate arthritis deformans and the whole series of peri-articular pains,

arthropathies, neuralgiæ, etc., which indeed seem to be quite distinct. But, although we pay less attention to former theories and outlines, it is impossible to disregard them entirely, in order to rise above isolated cases and to consider them more generally. As, moreover, therapeutical effects that are apparently the most brilliant are sometimes quite ephemeral, the necessity of discovering and contending with a superior pathogenic cause is imposed upon unbiassed minds.

The practical conclusion to be drawn from these premises is, that, while treating uterine and cutaneous lesions, the entire economy must be acted upon and, as far as possible, the nervous system must be restored to the normal condition of equilibrium. This advice is apparently almost trite, but it is really by no means superfluous, from the fact that each physician tends more and more to confine himself either to a specialty, or to the narrow circle of his own studies. He thus acquires a good competence in some cases, but he is led to neglect other branches of medical science, and above all general ideas; broad conceptions are abandoned, and that too, I do not fear to say, to the detriment of the important interests. What happens? When we find ourselves in the presence of a cutaneous lesion, no matter what, which we have not learned to treat, we do not fail to give the patient an exaggerated feeling of safety, and to encourage his carelessness with the fatal formula: "That will disappear of itself."

Well, it is wrong to hold nature responsible for existing crusts, scales, pustules, comedones, and disease of the sebaceous follicles or their surroundings. We must act, because, unless we do, the evil usually becomes aggravated and makes constant progress. When it heals spontaneously it leaves linear cicatrices, as if from the cut of a pen-knife (by which they are distinguished from the scars of small-pox), after having destroyed the hair-follicle and the sebaceous glands. This is too much. Again, if varicose enlargement continues, bloody operations or scarifications may sometimes be required. Many women, who are obliged by their profession to have unblemished faces, such as actresses, book-keepers, etc., must submit to surgical aid; they might have avoided this extreme measure if they had been treated at the outset.

I shall mention only three therapeutic indications which follow naturally from the foregoing, viz.:

1. Special treatment for the cure of the different forms of metritis and the regulation of the menstrual functions.

2. In general I think that the internal administration of alkalies may be useful; but I shall confine myself to recommending the use of nervous sedatives, above all the valerianates which do not irritate the skin, like bromide of potash, and the removal of all physical or moral causes of excitement. Over-exertion in all its forms, excess of any kind, the abuse of alcoholic liquors, etc., should be on the proscribed list.

3. As regards the cutaneous lesion, the treatment must vary according to the case. It is important for the prestige of the medical profession that it should not be abandoned to the charlatans and quacks of every sort, who pretend to rival in their results the most eminent of the school of Saint-Louis.

TENSION IN SURGICAL PRACTICE

INFLAMMATION OF BONE

AND

CRANIAL AND INTRACRANIAL INJURIES

BY

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TENSION, AS MET WITH IN SURGICAL PRACTICE.

LECTURE I.

ON THE CAUSES, EFFECTS, AND TREATMENT OF TENSION AS MET WITH IN SURGICAL PRACTICE.

When, through the kindness of my colleagues in the Council of this College, I was invited to accept the responsible position of Professor of Surgery and Pathology in this honored Institution, I acceded to their request as a matter of duty, although with much diffidence, as I felt mistrustful of my power to bring before an audience, such as is wont to meet in this theatre, either material of sufficient importance to excite their interest, or to place it before them in a way sufficiently attractive to satisfy their critical requirements. To excite your interest, I have therefore selected a subject with which practical surgeons have long been familiar, and the importance of which they have recognized, but concerning which there is little or no literature—I allude to that of Tension; and should I fail to make it sufficiently attractive, I have confidence that it will prove suggestive and tend toward some practical good. During the last few years the word "tension" has been freely used by both physicians and surgeons, although it has not been always employed with the same meaning. In my own student days it was rarely, if ever, heard; indeed, in a surgical point of view, it had then but little significance. At the present time, however, we read and hear of it in many senses. The physician talks to us of arterial and muscular tension,

and all admit that the word, as thus applied, carries with it deep meaning. The surgeon uses the term as applied to the pressure brought about by the distention or stretching of tissues by cystic or solid growths, by the extravasation of blood, and more particularly, by what is far more common—the effusion of inflammatory fluids. I propose, therefore, in the following lecture, to invite your attention to these different causes of tension, and to trace their effects. I shall do this from the clinical point of view, under the conviction that some practical good may be derived from a full consideration of the subject, and with the hope that some light may thus be thrown upon the diagnosis and treatment of surgical disease.

With respect to the meaning of the word "tension" as employed in surgical work, and particularly in clinical work, it most frequently means the pressure brought about by the stretching or distention of tissue from either the growth of some neoplasm or the effusion of some fluid; tension, in this sense, meaning distention or the stretching of parts by a force acting from within—by centrifugal pressure, as it may be rightly termed. It is, however, applied in another way; that is, to the stretching of tissues which have been divided and brought together by sutures, the strain upon the sutures from the elasticity of tissues being the measure of the tension.

The effects of tension will be found to vary according to the nature of the tissue subjected to its influence. In one of an elastic kind, which yields readily under distention, the effects of tension are neither much felt nor well displayed, unless the expanding or distending force be carried to its full extent; whereas in a tissue which is unyielding and inelastic the mildest distending force is resented, and the effects of tension are forcibly demonstrated. Again, when the distending or stretching medium acts *rapidly*, the tension brought about in the tissues is severe, the symptoms associated with it are serious, and its effects destructive. On the other hand, when the distending, stretching, or straining medium acts *slowly*, tension is seen acting at a lower level, its symptoms are modified in intensity, and its effects qualified. As a general rule, the severity of the effects of tension, as well as the severity of the symptoms which characterize its different degrees, is found to turn upon the acuteness of its action and the

elasticity of the tissues implicated. To this rule, however, there are exceptions.

The *ultimate* effects of tension upon any tissue turn, as already stated, upon the elasticity of the tissue and the rapidity with which the tension has been brought about; but they are invariably destructive. Its *immediate* effects, or mode of action, are primarily upon the circulation, particularly the venous; and the pressure from within of necessity tends to bring about—first a slowing of the capillary blood current through the stretched parts, and later on its stagnation, from which the death of tissue follows. When tension is very great, the venous and probably the arterial circulation through the tissues may be absolutely arrested. The nerves of the implicated tissues are at the same time stretched or pressed upon, and as a result pain is produced, and the severity of the pain is determined by the degree of pressure or stretching to which the nerves are subjected, and the character and quality of the nerve supply to the part. The pressure of tension, being centrifugal, acts all round. When the tension has been brought about by the effusion of inflammatory fluids, the effects described are aggravated, for the blood stasis which is well known always to exist in inflamed tissues is encouraged by tension; but of this later on. Where tension occurs in tissues which are not inflamed, inflammation is excited even when the tension is maintained at a low level. Where tension is more severe, destructive inflammatory changes rapidly supervene; but where it is most severe, the death of structure may result from tension without inflammation. Surgeons are familiar with many of these facts in their treatment of wounds; for it is to prevent tension and its evil effects that the drainage of deep, indeed of all, wounds is of such primary importance.

Symptoms of Tension.—The one subjective symptom to which tension gives rise is pain; and this is always found to vary with the degree of tension to which the tissues are exposed, and the quality and quantity of the nerve-supply to the part. Other things being equal, a low degree of tension is associated with slight pain, and a high degree of tension with intense pain. Pain under all circumstances has a common relation to tension. In parts badly supplied with nerves, or at any rate with sensitive nerves, there may be tension and yet no pain, even when from tension the vitality of the stretched

tissues may be destroyed. An ovarian cyst, for example, may be so tense as to be deprived of life, and this change be unattended by pain.

The Diagnosis of Tension.—In superficial structures tension can, as a rule, be readily estimated by palpation. In deeper parts this may be difficult; in bone, or in the cranial cavity, it is impossible. An educated finger can, where palpation is applicable, be brought to diagnose degrees of tension, as indicated by elasticity and hardness; although where the tense tissues lie deep this may be difficult. Where tension is not acting at its highest force, what is known as fluctuation may be made out. Where it is so acting fluctuation may not be found, only unyielding hardness of the parts implicated. The degree of tension of the part can, however, be determined by palpation, as in the eye, when the affected organ is compared with that of the sound side. The aspect of a tense tissue, moreover, helps diagnosis; its palpable enlargement as compared with the opposite and unaffected part, and its stretched appearance, being suggestive. In such a joint as the knee this condition can be well observed. But when the tense tissue it well covered with soft parts, as in a femur the seat of periostitis, this observation cannot be made; but even there the enlargement of the part, and the engorged veins visible upon its cutaneous surface, are of diagnostic value as indicative of deep pressure. The diagnosis of tension of superficial, or comparatively superficial, structures can therefore be made with accuracy by observation and palpation; whereas, of deeper structures it can only be rationally inferred. Its existence can, nevertheless, be generally tested by surgical means, and its degrees measured. I must not, however, allow myself to dwell upon the diagnosis of tension under all circumstances, but with these general remarks, which have been made to clear the way, I will pass on to consider the effects of tension as brought about by the growth of tumors and the extravasation of blood, to those of tension, the result of inflammation, which probably forms the most important feature of the whole question.

On Tension from New Growths.—Where tissues are stretched or distended by a new growth of a non-infiltrating or innocent character, and its increase is slow, the effects of tension upon the parts which cover it depend greatly upon

the character of the tissue in which it is placed and its capacity for yielding. Thus, if the tumor be a subcutaneous lipoma, there is rarely pain, as there is no tension; and where pain is present, it is probably due to the implication of some cutaneous nerve. Should the tumor be more deeply placed, as in the breast, which is covered by skin and fascia, and still be innocent, there is not pain of any significance so long as the tumor is small and does not give rise to stretching or distention of its coverings, and what pain exists will probably be of a dull kind. The skin over the tumor, however, as growth continues, changes in appearance, and its normal healthy aspect becomes congested. The engorged vessels are at first few, but later on many, so that at last the surface of the tumor assumes a congested leaden hue. The slow tension of the tissues thus brings about a gradual blood stasis, which passes into or induces the condition of inflammation, and subsequently of ulceration; tension, acting at a low level for a lengthened period of time, always bringing about, although slowly, destructive changes. Should a simple solid or cystic tumor originate in still deeper structures, and be covered with a dense fascia, a very different series of symptoms has to be described. As soon as the fascia becomes stretched or the deep parts distended, tension or centrifugal pressure is produced, and with it pain becomes a symptom of more or less gravity; the character and severity of the pain being determined by the sensibility of the parts involved, the degree of distention of the tissues, and the nature of the nerves involved or pressed upon. For example, a tumor situated between muscles loosely surrounded may, in its early stage, cause little or no pain, since the parts yield under distention; but as it grows and stretches its fascial coverings, pain appears and steadily increases. If growth still continues and the tension of the fascia becomes great, the pain from tension is not only severe, but it is aggravated by the backward or deep pressure of the tumor upon the nerve-trunks of the part in which it lies; the pain of local nerve pressure being added to that due to distention.

Again, should a tumor originate in the sheath of a nerve, pain is at once produced and rapidly inreases in severity. The tumor, by its expansile growth not being able to bring about a yielding of the nerve-sheath, presses backward upon the

nerve-fibres, and causes suffering. To illustrate these points the following cases may be cited.

Case I. *Tumor in the Temporal Region beneath the Temporal Fascia and Muscle; intense Local Pain from Tension.*—Mrs. C——, aged thirty, came under my care in January, 1865, for a swelling in her right temporal region, which had been growing slowly for three years. It was hard and fixed to the temporal bone, and pressed forward to the zygoma. The jaw was quite fixed, and could not be moved, apparently because of the stretched temporal muscle. The seat of swelling was the site of intense local pain, evidently due to stretching of the tissues. The lady subsquently died of exhaustion, after nine months of intense suffering.

Case II. *Tumor in a Nerve-sheath (median); Removal; Cure.*—Miss P——, aged twenty-three, came under my care in August, 1876, with intense pain in the parts supplied by the median nerve of the right hand, contraction of the fingers and inability to extend them on account of pain, and a deeply-seated swelling, about the size of half a hazel-nut, above the anterior annular ligament in the median line of the forearm, The pain had been present for four or five years, but the swelling had only been noticed about six months. It had been mistaken for a ganglion and been punctured, but without relief. I regarded the case as one of neuroma in the median nerve, the tumor pressing upon the nerve exciting pain and forbidding extension. I therefore made a clean cut down upon the nerve, and turned out of its sheath a cystic growth the size of half a nut. (Prep. Guy's Museum, 1614^{51}). Immediate relief was given, and a good cure followed, the movements of the hand being perfect.

Case III.—In 1882 I removed from the upper cord of the left brachial plexus of a lady about fifty years of age a cystic tumor the size of a large hazel-nut, which had been growing for many months. It had caused intense pain down the arm, chiefly in the course of distribution of the musculo-spiral nerve, and from its hardness felt very like an exostosis. On exposure in the subclavian triangle, it was found to be in the upper nerve-cord of the brachial plexus, and within its sheath. On division of the sheath the cystic tumor rapidly enucleated, and this process clearly proved the tension to which the parts had been subjected, and explained the severity of the pain the patient had experienced. Dr. Goodhart reported that the growth seemed to be a blood-cyst. A good result followed the operation, and the lady is now well. (Prep. 1614^{5} Guy's Museum.)

When tumors originate in bone, there is, under certain conditions, severe pain, while under others there is but little.

The presence or absence of pain and its degree are regulated by tension. For example, suppose a solid or cystic growth originates in the antrum of the upper jaw. As it grows it tends toward the expansion of its bony casing, and gives rise to tension. As a result pain is induced. This, however, is not often very severe; for the thin bony wall, as a rule, gradually yields to the slow pressure for within, and in due time gives way, thus relieving tension. As a consequence, what pain may have been present, at once becomes ameliorated, and what is left is to be explained rather by the implication of the nerve-trunks of the part than by tension. When the shaft of a long bone becomes the seat of a cystic growth there is more pain, and this pain is from tension, since the wall of bone which surrounds the cyst is dense and unyielding to the centrifugally expanding pressure of the cystic growth. The pain in a case such as this is of the usual aching character, but it does not appear to be aggravated by the warmth of bed, as in inflammatory troubles. These points are well illustrated in the following case.

Case IV. *Expansion of the Shaft of the Tibia from a Cyst; Trephining of the Bone; Recovery.*—Henry D——, a healthy man, aged twenty-four, came under my care at Guy's Hospital on January 6, 1871, with considerable expansion of the centre of the shaft of the right tibia, which had been coming for two years. He had at times suffered much pain in it, but as a rule it had little more than ached after exertion. He had never had syphilis, and no history of an injury could be obtained. When seen, the bone was found to be expanded in its centre to twice the diameter of the normal bone. The surface of the swelling was much grooved by the cutaneous veins, and the integument over it was slightly œdematous. The parts were tender on firm, but not on gentle, pressure, and the seat of a dull, aching pain, which it is not stated was worse at night. On January 13th I cut down upon the swelling and trephined the bone with a large-sized instrument, and exposed, one inch from the surface of the bone, a cavity as large as a full-sized walnut, which was lined with membrane or granulation tissue, and contained serum more or less blood-stained, but no pus. It was not a hyatid. The bone cut through was denser than natural, and the periosteum over it was thickened. After the operation all pain ceased and a rapid recovery ensued. When I saw the man three years later he was quite well. The enlarged bone had contracted to its normal dimensions, and, beyond the scar of the operation, there were no indications of trouble.

On the other hand, should a solid sarcomatous growth originate in the centre of a dense bone in which there is but little cancellous tissue, such as the lower jaw, in which also there is a canal containing a sensitive nerve, tension in its highest force is the result. This was forcibly illustrated in a case of my colleague Mr. Cock, many years ago at Guy's.

Case V.—A man had a fibrous tumor growing in the dental canal of the lower jaw, and involving the inferior dental nerve. The agony this man suffered was excruciating, and the relief he experienced by the operation of trephining the bone and removal of the growth was almost magical. In this case the dense bone which surrounded the tumor resisted the effects of steady pressure, and was not absorbed as cancellous bone would have been. The effect of distention or tension upon the walls of the cavity containing the growth was consequently strongly marked and made manifest by pain, which was in its turn intensified by the compressing influence of the fibroma backward upon the dental nerve. As an example of tension brought about by a slowly developing solid growth in unyielding sensitive structures, I am unable to adduce a better.

Tumors of bone do not, however, always distend bone and give rise to tension. Solid sarcomatous growths, which originate in the cancellous tissue of the long bones, rarely do so, at any rate to any extent; for the tumor, as it grows, by its constant pressure steadily causes atrophy or absorption of the bone. And the enlargement of the cavity in the bone going on *pari passu* with the increase of the tumor, neutralizes the effects of tension, and reduces its influence to a low degree. The patient, consequently, under these circumstances, suffers but little, and what pain exists is rarely of a severe or constant kind. As the tumor grows, however, the little pain which may have been present disappears, for the bone after a time becomes perforated by the growth, and tension therefore ceases to exist. With its disappearance pain at once diminishes, and unless the growth presses upon nerves, or structures well supplied with nerves, its progress is probably almost painless. It would appear, therefore, that in the growth of tumors of the soft parts, as well as of bone, the influence of tension is one which cannot be ignored. As the chief cause of pain, directly or indirectly, it is a potent factor, and as a clinical symptom it is one of great diagnostic value.

With this brief reference to tension of tissues, as induced by the growth of solid or cystic tumors, or to what may be called slow tension, I must pass on to consider tension as the result of sudden effusion, and more particularly of blood, to which class the term acute or rapid tension seems applicable. When a cavity or tissue becomes suddenly distended from any cause, the amount of tension which ensues is inversely proportionate to the yielding elasticity of the walls of the cavity or tissue itself. The effects of the distention turn upon the degree of tension that is produced; and the symptoms to which the tension gives rise vary with the nerve supply to the part. Thus, in every-day practice, where blood is effused, as a consequence of an injury, into subcutaneous tissue which is thin, elastic, and capable of distention, as in the eyelids and scrotum, the patient experiences but little pain or other morbid sensation beyond a feeling of fulness, unless the hæmorrhage is great and the parts are stretched to their utmost. Whereas, should the effused blood be rapidly poured out into the skin of the ear, the junction of the nose with the upper lip, parotid region, or outer labium, parts which are not only sensitive but incapable of much stretching, the pain is severe, and this symptom is entirely due to the stretching or tension of the tissues into or beneath which the blood has been extravasated. Where no distention of parts exists, and as a consequence there is no tension, subcutaneous hæmorrhage may take place to a considerable extent and give rise to little local pain or other symptom than local swelling. The pain which attends subcutaneous hæmorrhage is in proportion to the degree of stretching or tension of the parts implicated. No tension means little pain; severe tension severe pain. When hæmorrhage takes place beneath the deep fascia which binds down tissues, pain is often severe; the distention of the fascia, the tension of its fibres, and the centrifugal pressure generally, being its cause. This is fairly illustrated in a case of simple fracture above the ankle, and in most sprains of joints attended with blood effusion. As the blood is absorbed, pain goes and repair progresses.

When we consider the subject of hæmorrhage into cavities, and the symptoms it produces, the same conclusions are arrived at. Thus, a patient may bleed to death from hæmorrhage into the peritoneal cavity, without manifesting any other

symptoms than those which are described as general. There is no pain. The same may be said with respect to bleeding into the thorax. In neither of these cavities can tension, as a result of bleeding, be well produced, and as a consequence there is no pain. In intracranial hæmorrhage, where there is no yielding of external tissues, but only backward pressure, the effects of tension are very marked and destructive.

When bleeding, however, occurs into cavities which are within the range of distention, and in which, therefore, the effects of tension or centrifugal pressure may be felt or demonstrated, a different result has to be told. Thus, when a knee-joint is the seat of fracture of any of its bones, and as a consequence hæmorrhage takes place into the joint, the cavity may become so distended with blood, and thus tense, as to produce severe local pain and general disturbance, which, if not relieved, may be followed by the destruction of the joint. The eyeball may be the seat of extravasation of blood into its anterior, middle, or deeper chamber, and its presence be unattended by any pain, unless the hæmorrhage be sufficiently extensive to distend the globe and give rise to tension. The tunica vaginalis of the scrotum may likewise become the seat of hæmatocele, and the amount of pain associated with it will turn upon the rapidity of the effusion and the mechanical distention or tension of the walls of the cavity into which the blood has been poured. The pain in all these cases, when it occurs, is clearly dependent upon tension.

When hæmorrhage takes place into deep, unyielding, and possibly sensitive structures, the degree of pain to which it gives rise can hardly be measured.

Case VI.—Some twelve years ago I was asked by the late Dr. Remington, of Brixton, to see a fine young man, of about twenty-five, who, the day previously to my visit, had received a blow upon one of his testicles, and from the time of its receipt had suffered intense local pain, which opiates and local treatment had failed to relieve. When I went into his room the patient was walking about with his hands grasping his genital organs, and moaning with agony. In one testicle there was intense pain of a throbbing character, and the pain had since the accident been so severe that the patient said he had neither slept nor rested. I examined the scrotum, and failed to see any external signs of injury. The painful testicle was, however, larger than its fellow, and this enlargement

was in the body of the gland. On careful manipulation, I made out a tense point in the body of the testis, and this point was painful. The man's temperature was normal, and there did not appear to be any local heat about the testicle. I came to the conclusion, therefore, that in this case the patient was probably suffering from hæmorrhage into the body of the testicle itself, and that the intense pain which was experienced was due to tension. I consequently persuaded him to allow me to introduce a fine exploring trocar and cannula into the swelling; which I did, giving exit to a jet of blood or blood-stained serum which spurted out in every direction. With this spurt all pain ceased, and a rapid convalescence followed. That the pain in this case was due to the tension caused by the rapid effusion of blood into a sensitive gland encased in an unyielding fibrous covering—the tunic albuginea—there can be little doubt; and with the diagnosis the treatment was simple.

CASE VII. *Puncture of the Testicle in the Operation of Tapping a Vaginal Hydrocele; Hœmorrhage into the Testicle Producing Pain from Tension; Operation and Recovery.*—Mr. D——, aged twenty-one, consulted me in March, 1871, on the advice of Dr. Tyson, of Folkestone, for some affection of his left testicle, which had been swollen for ten years or more, but had only been painful since it had been surgically treated. One month before I saw him he went to a surgeon, who tapped the swelling and drew off a blood-stained fluid mixed with blood-clot. When the instrument was withdrawn the swelling steadily reappeared, and the testicle became the seat of intense pain, the pain passing up the cord. Since then the swelling had steadily increased, and the pain had been sickening. When I saw him the testicle was the size of a cocoanut, ovoid in shape, smooth, and very painful. It was not hot. Thinking the case might have been a hæmatocele of the tunica vaginalis, although the extreme pain suggested something else, I at once explored the tumor by means of an incision, and found that it was a hæmatocele—but of the body of the testicle, and not of the tunica vaginalis. There had evidently originally been a hydrocele of the tunica vaginalis, for when I operated there was evidence of this fact; but the testis itself had been converted into one large cyst containing broken-up and fœtid blood. I removed the whole organ, which was useless, and a good recovery ensued. In this case the testicle had doubtless been punctured when the hydrocele was tapped, and as a consequence hæmorrhage followed the puncture. The pain which came on after the operation of tapping, and which had not existed before, was clearly due to tension within the testicle brought about by the bleeding.

I have another case of tension brought about by the ex-

travasation of blood, which I should like to relate, since it is well in point.

Case VIII.—In 1877 I saw with Dr. Donald Hood, of Green Street, but then of Caterham, a gentleman who in a hunting accident had ruptured his urethra, and was suffering from retention and urinary extravasation. These symptoms were relieved by perineal incisions and catheterism, and all went well for three days, when bleeding from the urethra again appeared, associated with agonizing pain at the root of the penis. On examining him through the wound, which I then did, I found the bulbous portion of the urethra very tense and exquisitely painful, and it was clear that this tension of the part was due to fluid. I accordingly made an incision into the bulb, and with the incision what must be described as an explosion at once occurred, for blood was scattered in all directions. Copious bleeding followed, which clearly came from the artery of the bulb. The hæmorrhage was controlled and all eventually went well. The tension of the bulb in this case from arterial hæmorrhage was testified by the presence of intense local pain, and it was proved by the explosive sound caused by the division of the distended tissues, as well as by the scattering of blood upon the operator and his assistants as soon as the retaining capsule was divided.

Tension in these cases was acting at its highest force, and, as the parts implicated were highly sensitive, severe pain was the result. Tension being relieved in every case, pain was banished, and repair went on in its normal way.

This accumulative evidence which I have brought together, I think, therefore, points to one conclusion—that tension and pain as met with in cases of growths, expanding tissues, or of hæmorrhage into tissues and cavities, are closely related; in fact, that pain in these cases is the result of tension.

On Tension the Result of Inflammation.—I will now pass on to consider the subject of tension in its relation to inflammation, and need hardly remind you that swelling is one of the classical symptoms of the process, and that this swelling is due to the exudation from the slowly flowing blood stream of corpuscular liquid which passes through the inflamed tissues, and which may lead up to blood stasis; this slowing of the blood current and consequential exudation forming Sanderson's central phenomenon of inflammation. Indeed, these elementary truths are such as every student and practitioner should ever have before him when considering any inflamma-

tory affection, for they form the key to an intelligent appreciation of the local symptoms and pathological phenomena of every case. When effusion takes place, therefore, into any tissue which is inflamed, swelling follows, and the amount of swelling turns upon the character of the tissue into which it takes place. Where there is much connective tissue, and the parts are elastic and yield to distensile forces, the swelling is great; but as the resistance to it is not serious there is little or no tension; such an effect only follows extreme distention. Where the effusion is poured out into connective tissue contained in fibrous sheaths, or beneath or within fascial envelopes, as in joints, the distending force is great, and tension consequently is often found acting to a high degree; and where it exists in bone or in unyielding bony cavities, tension of the severest type is met with.

That local pain is a sign of tension all agree, although all will probably not consent to the opinion that tension is the cause of most pain. In inflammation, however, I think there can be little doubt as to the truth of this view, for pain and tension seem to be practically proportionate, the former being felt in exact proportion to the degree of the latter, and rising and falling with its force. Indeed, in a clinical point of view, I believe that the pain of tension should be regarded as a test symptom of inflammation. Where there is feeble tension in any inflamed part, the pain hardly exceeds that of uneasiness; where there is high tension, the suffering is severe; where tension is relieved by natural or surgical processes, pain goes. Under all circumstances, the presence of pain in any local inflammation may be accepted as a sign and indication of tension and a call for its relief. When pain is increased at night —that is, when the patient is warm in bed and the circulation is acting at its highest force—the probabilities are that the affection is inflammatory, and that such increase in the force of the circulation which is promoted by warmth tends toward the production of tension or its aggravation.

The *effects of tension* upon the inflamed tissues depend much upon its degree. When it is but slight, tension may tend only toward the maintenance of the inflammatory process; when it is more severe, it must help, not only to keep up, but also to aggravate, the action; and when it is acting at its highest force, there is no escape from the conclusion that it

assists powerfully to bring about the destruction of the tissues which feel its immediate influence, and to encourage inflammatory action in such as are more remote. How it helps to bring about destruction of inflamed tissue is not difficult to understand, since it acts in tissues that are inflamed in the same way as it has been shown to act in such as are not so affected—that is, by helping to bring about blood stasis. In tissues that are inflamed the tendency to blood stasis invariably exists, so, with tension acting upon them, there can be no surprise that this blood stasis, with all its evils, is greatly encouraged. To say, as students are taught, that death of inflamed tissue from tension is due to the cutting off of blood supply to the inflamed part is a fundamental error. The blood is in the tissues, but it is stagnant and not circulating. The death of inflamed tissues from tension takes place, as it does in a strangulated part, from the stasis of its own venous blood. It is a form of static, not of anæmic, gangrene—of death of tissue brought about by the stagnation of the blood in the capillaries, and not by a want of blood supply.

I will now proceed to illustrate the effects of tension upon different tissues; and first of all let me take as an example a case of cutaneous erysipelas, and assume that it has attacked the skin of a part loosely connected with the deep tissues and capable of ready distention. The local sensation produced by the disease does not go beyond a sensation of stiffness—it does not amount to pain; but let the inflammation spread to parts so placed as to be anatomically capable of but little, if any, distention, how different then are the symptoms complained of, and how soon inconvenience passes into pain, even of an acute kind. Let any one who has had erysipelas, or any inflammation of the nose, upper lip, nape of neck, or ears, answer this question, and at the same time tell us the comfort he experienced when the tension was mechanically relieved. In this example of cutaneous inflammation the view that local pain is fairly due to tension is well supported, and the relief that is given to the symptoms by local treatment helps the conclusion.

Let me now draw an illustration of the effects of tension from inflammation of a deep structure bound down by inelastic tissues, such as is met with in a familiar example of thecal inflammation. What pain is at once experienced here from the first onset of the trouble, and how rapidly it intensifies!

What destruction of tissue follows if relief be not given! And what comfort and rapid recovery ensue if the case be rightly treated! These facts are familiar to us all, and yet I am rash enough to say, even in your presence, that I am somewhat in doubt as to whether the generality of surgical practitioners realize their full meaning, and so conform their treatment to the exigencies of the case as to give their patient the best chance of a recovery. Let me take this example of thecal inflammation, therefore, as a text, and enlarge upon it, first of all following its natural course. Inflammation attacks the tissue; the capillaries of the inflamed part consequently become more or less thrombosed, and as a result effusion takes place. The effusion is confined in a tight channel, the walls of which are but feebly capable of yielding, and as a consequence the fluid, pressing centrifugally everywhere, not only violently stretches or distends the tissues in which it is confined and gives rise to high tension, but also seeks a vent by flowing in the line of the least resistance along the course of the tendon up the fore-arm. From this pressure, if relief be not given, death of tissues speedily follows, this result being brought about, as already described, by the influence of tension in encouraging the blood stasis which forms part of the process of inflammation. With the death of tissue suppuration within the thecal channel takes place, rupture of the weakened thecal structure follows, and in the end comes the external discharge of the dead tissues, with probably many burrowing abscesses. A vast amount of destruction of tissue from tension has taken place quite unnecessarily, since by active and scientific early treatment a very different result could have been obtained. The cause of all this extensive trouble was practically due to tension, and if this had been relieved in its early origin recovery would have been possible, nay probable, without loss of structure.

The inference to be drawn from such a case as this, and from all others like it, is that to relieve tension by giving vent to pent-up fluids in distended tissues is a primary surgical duty, and that this practice cannot be applied too early, may safely be dogmatically advised. At the present day among experienced surgeons it may be said that this practice is fairly universal; but is it? Is there not even now a lingering dread in some surgeons' minds of incising or even deeply puncturing

an inflamed tissue before suppuration has commenced? And have not many of us heard, when an incision has been made into such inflamed tissues as those just mentioned, something like an observation of pleasure that a fluid like pus has been seen to flow, as if to justify the act? Whereas the surgeon's pleasure should be where his duty lies, to give vent to pent-up inflammatory fluids before suppuration or other destructive changes have taken place. In my own practice, I as a matter of routine cut down freely and immediately upon a finger the seat of thecal inflammation, and always congratulate myself that I have done so when only serum and blood escape, and no pus; for the existence of pus means destruction of tissue under most if not all circumstances, a result which should be avoided.

Again, let me give another example. A joint, let me say a knee- or hip-joint, becomes inflamed and acutely distended with inflammatory fluids. The synovial membrane as a consequence becomes tense from distention, and there arises the natural fear that disorganizing changes in the joint will soon occur, if the tension thus produced be not relieved. The joint consequently is either aspirated or punctured with a tenotomy knife through a valvular subcutaneous wound, to relieve tension, and *some little* of the serous exudation is drawn off or allowed to escape into the connective tissue, where it will become absorbed. This little operation at once not only relieves pain by relieving tension, but it does more, for in a few days the fluid which was left in the joint disappears by natural processes, and convalescence is soon established.

An acutely inflamed bursa may be similarly dealt with, and an equally good result expected; and in the following case a like treatment of a hydrocele was followed by a like result. The case I give in the words of Dr. Bower Harrison, of Manchester.

Case IX.—"In March, 1878, I was myself the subject of hydrocele of about seven or eight months' duration. On the 20th instant, on getting out of a warm bath, I introduced an ordinary hypodermic syringe into the hydrocele, and, using it as an aspirator, removed about ten minims of fluid. A few drops of water remained on the spot where the syringe had been used. This dew continued to show itself for some time afterward, while a perceptible softening of the whole tumor took place. In a few days the hydrocele had perceptibly di-

minished, and in a short time had wholly disappeared. It never recurred. In mentioning the case to my friend, Professor Lund, of Manchester, he expressed himself as much interested, saying that he felt convinced that the diminution of tension in the case of an imprisoned fluid greatly promoted its absorption. He further stated that he was in the habit of speaking of this to his class as an important *law*." I am quite convinced that our friend, Mr. Lund, is right in this matter. Indeed, I have for years taught this law myself. The withdrawal of some of the distending fluid from a tense synovial or serous sac not only relieves pain with the tension of the part, but at the same time frees the lymphatic, venous, and arterial circulation from the impeding effects of local pressure, and thus, by encouraging a more normal or healthy action of the vessels generally, tends toward the relief of the blood stasis, which is the main important pathological condition of inflammation, and thus helps toward recovery. In the same way the contents of an abscess may often become absorbed by natural processes, after a sufficient quantity of its contents has been withdrawn to relieve tension.

Again, glaucoma attacks the eyeball of a patient, and, whether acute or chronic, is attended by distention of the globe of the eye and extreme pain, the result of tension. Its treatment consists in an operation for the relief of tension, and without an operation in one of its forms recovery is considered by all authorities to be hopeless. "We must always bear in mind," writes my colleague Mr. Higgens, "that an operation to be successful must be performed early," the author meaning by "early" that it should be undertaken before the secondary changes in the structure of the eye, the result of distention, have been brought about. Surely this principle of practice, which is so binding and valuable in the treatment of an affection of the eye due entirely to tension, should be equally binding, as it would be equally valuable, in the treatment of all local inflammations in which tension has such a pervading influence.

Acute inflammation of the pulp of a tooth affords another illustration of the evil effects of pent-up inflammatory fluids upon surrounding parts, and of the severity of the local symptoms which must be attributed to such a cause. "In this case," writes Moon, "every factor for the production of agonizing pain is present; the distensible pulp, largely supplied with nerves, undergoes vascular engorgement within an unyielding case—closed in all parts except at the aperture of

exposure." The trouble, if left unrelieved, soon ends in the death of the plup, and too often in the extension of the inflammation to the periosteum of the jaw-bone and surrounding parts, with its ultimate bad effects. How many of these consequences may be avoided by judicious treatment I must not now stop to inquire; clearly the majority. Where the antrum of Highmore is involved in acute inflammatory trouble the same conditions are present. Tension, and as a result, pain, are prominent symptoms, and these are only to be relieved by surgical action.

In the surgical affections of the ear many illustrations of the same truths may be found. In furuncles and inflammation of the external meatus, as is well known, severe pain is experienced, the pain being the direct result of the unyielding condition of the skin and connective tissue in which the inflammatory process originates, and the effects of the tension being indicated by the throbbing pain, the feeling of fulness in the part, and the general febrile disturbance which in these cases is so often present. In acute inflammation of the middle ear, or in the acute grafted upon a chronic affection, the evil effects of tension are forcibly illustrated, for in such cases the walls of the inflamed cavity are chiefly bony; and where this is not the case, the foramina, which communicate, on the one hand, directly externally, and, on the other, indirectly internally, with the cranial cavity itself, are only covered with a membrane. When this cavity, therefore, is filled with inflammatory fluid, and the inflammatory process continues, the full effects of the centrifugal distending force upon the walls of the cavity, in bringing about tension on its yielding and unyielding walls, is very marked. Indeed, it may be said without fear of contradiction that there are few local inflammatory affections which give rise to more severe local or general symptoms than otitis media. The severe and agonizing local pain, radiating in all directions, the high fever and general constitutional disturbance, and too often the brain symptoms and complications which mark its natural progress, all point to the evil effects of pent-up inflammatory fluids, while the rapid influence of sound local treatment support a like conclusion.

Again, in inflammation and suppuration of the kidney brought about by the presence of a calculus or any obstructive

cause in the urinary track, the same conclusions find full support. In these cases the lumbar or kidney pain—usually synonymous—turns almost entirely upon the tension or distention of the pelvis of the kidney. When, from any cause, the ureter of a kidney thus affected is obstructed, pain is caused or increased; when the ureter opens and allows the free exit of pus, pain diminishes, or even disappears. The disappearance of the pain depends entirely upon the unblocking of the ureter and the consequent relief to tension of the pelvis of the kidney. On this account a patient with a disorganized kidney may go on for years, suffering when obstruction to the flow of pus takes place, and being comparatively easy between whiles.

Indeed, in any suppurating cavity the same cause and effect can be traced. Retained pus always gives rise to pain more or less severe, and its severity turns upon the distention of the abscess cavity. When the tension is brought about suddenly, and is severe, the pain is great, as in acute abscess; where it is produced by a chronic process, the pain often is but little, tension being little. The pain of abscess generally turns almost entirely upon the tension of the walls of its cavity, and its severity upon the rapidity with which the tension is brought about, the anatomical surroundings of the part having its due influence. If further illustrations of the effects of tension were needed, abundance might be adduced from the surgery of inflamed periosteum and bones. For my present purposes such are not required, although in another lecture I propose to bring the subject before you as a whole.

I must, however, as a final and possibly convincing exemplification of the truth of all my preceding remarks, refer to *tension as seen in wounds*, the result of either accident or operation.

In the treatment of wounds, and more particularly of deep wounds, the evil effect of tension upon the process of repair is well recognized; and it may, I think, be said that, if wounds are treated upon approved modern methods, the subject of the wound be healthy, his surroundings wholesome, and due provision be made against the possibility of any fluid exudation from the wound being retained, so as to give rise to tension, the surgeon may with confidence look forward to the reparative process being carried out without the slightest

trace of inflammation, and without pain; whereas, if this important point of treatment be forgotten, disregarded, or inadequately provided for, the slightest trace of tension upon the margins of the wounds, or of distention of its depths, will to a certainty show its evil effects, not only by preventing quick or any form of union, but also by changing the quiet physiological process of repair into the pathological which we call inflammatory, and thus set up a destructive in the place of a constructive process. This result ensues quite irrespective of the form of wound dressing that may have been employed.

I should like from this chair to repeat what I have been long teaching, and what modern surgery has done so much to inculcate, that repair and inflammation are not only not identical but incompatible; that repair is a physiological constructive restorative process, while inflammation is a pathological destructive one.

When inflammation attacks a wound that is healing by John Hunter's first intention, arrest of repair first appears, then disrepair, and the injured tissues will, when the inflammatory process has subsided, have to heal by granulation. Should, by some chance, inflammation attack a healthy granulating surface the granulations will at once break down, and the molecular death of tissue, or the ulcerating process, take the place of what had been the reparative; the constructive process in both cases having been destroyed by the inflammatory and exchanged for the destructive. In the repair of all parts which have been damaged by the inflammatory process, inflammation must cease before repair begins. I would that this view of repair and inflammation were more generally entertained; it would help clinical surgery, for it would lead all surgeons, in their treatment of wounds, to avoid and guard against every outside influence that can possibly give rise to the over-action which we call inflammation, whether such be the introduction or germination of microbes from without, or the effects of tension from within.

I am not, however, here discussing the general causes of local inflammation. My object is simply to show that tension in wounds may either originate or keep it up; where the tension is severe, acute inflammation will follow, as in tissues which are not wounded; where it is acting at a lower level, it

will still be destructive, although less so in degree. Should sutures of any kind be introduced to keep the edges of a wound together, and upon one or two the effects of tension be felt, at such points local inflammation will originate and pass on to ulceration. Whereas about the other sutures at which there is no tension, and yet which in other respects are similarly placed, no such action will be found to exist. And this result will occur quite irrespective of the nature of the sutures employed, and however carefully the antiseptic or other treatment of the wound be carried out. The local inflammation in these cases is clearly due to local causes, and to no other.

Again, if in a deep wound, blood or serum is allowed to collect in sufficient quantities to separate its adjacent surfaces, and by so doing give rise to tension of the surrounding tissues, inflammation will to a certainty follow, and such will pass on to suppuration if the tension be maintained. Whereas, if the tension be relieved soon after its appearance, the inflammation will soon subside, and the reparative process resume its physiological work. The wounded surfaces, however, under both circumstances, are not likely to unite by quick or primary union, but by the slower process of granulation. In fact, the influence of tension upon the repair of wounds, both as a cause of inflammation as well as a source of its persistency, supports, if it does not prove, the following conclusions which the consideration of tension associated with other conditions has led me to draw.

1. That tension has a wide pervading influence in clinical surgery, as well as a decidedly marked effect upon the progress of disease.

2. That it is the product of many causes, and that these, for clinical purposes, may be conveniently divided into the inflammatory and non-inflammatory.

3. That it stands foremost among the causes of pain, and in inflammatory affections it is probably the chief pain factor.

4. That where the causes are not inflammatory the tension to which they give rise will, if maintained for any time at a low level, or rapidly rising to a high level, excite inflammation in the tissues affected.

5. That, where the cause is inflammation, the tendency of tension is to keep up or intensify the inflammatory action, and strongly to encourage its destructive influences.

6. That tension in every degree has a destructive tendency, and the rapidity of the destructive process has a direct relation to the acuteness of the tension.

7. That, as in wounds the slightest degree of tension is injurious, so, in their treatment, the use of the drainage-tube, or due provision for complete drainage, is a point of such primary importance as to relegate to a secondary position the mode and character of the dressing which is employed, since a want of attention to the efficient drainage of a wound under every form of dressing is followed by the same result.

If these conclusions be true, and I am satisfied that in the main they are, two others ask for expression, the first being the value of local pain as a clinical sign of tension and an indication for local treatment; and the second the expediency, if not necessity, of relieving tension as speedily as possible under all circumstances. To both of these points I must briefly call your attention.

The Treatment of Tension.—If arguments were needed to support the view that the pain associated with a local inflammation is chiefly due to tension, they would be found in its treatment; for if the local inflammation be situated in an extremity—say a hand—the local pain will at once be relieved by such a simple measure as elevation of the limb; the elevation tending at once to empty the venous capillaries, and at the same time to diminish the force of the arterial blood supply to the inflamed parts, and thus to relieve the blood stasis and the tension resulting from it. On the same principle, the arrest of the flow of blood through the main artery of the limb by temporary pressure, or the more or less complete and permanent occlusion of its lumen by temporary or permanent ligatures, has been found to act beneficially. By such means pain is at once relieved, and other advantages at the same time secured. Local venesection, leeching or cupping in either of its forms, must also act in the same way, by relieving tension; the local abstraction of blood from the seat of an inflammation or its neighborhood so emptying the congested vessels in the outer zone of an inflammatory centre as to encourage the circulation of the part generally, and by so doing give relief to the overgorged and dilated capillaries of the centrally inflamed tissues. The local loss of blood, even when very limited in extent, relieves tension, and with it its diagnostic

symptom, pain. In the same way, it is probable that cupping, dry or moist, and counter-irritation, have a beneficial tendency, and that these means, by drawing blood to a part not too remote from the seat of inflammation, help to relieve the congested capillaries in the focus of disease, and thus to favor the circulation through them; this favoring of the circulation tending, of necessity, to discourage blood stasis and hyperæmia, to relieve pain, and to help the natural powers to bring about a cure of local inflammation by resolution.

In the inflammation of soft parts, where the stretched tissues are elastic, their natural resiliency may have a beneficial influence toward the re-establishment of the circulation and the favoring of a recovery by resolution; whereas, in the inflammation of the more inelastic and unyielding structures such as the eyeball, middle ear, joint capsules, periosteum, and bone, no such help can be counted upon; for when these parts become the subject of acute or chronic inflammation, and consequently the seat of tension, such tension and inflammation, unless relieved by surgical art, will continue, and thereby bring about permanent or destructive changes in the inflamed parts, the result being in one case thickening and consolidation of structure, and in the other suppuration, ulceration, or death of tissue. It would therefore appear that in the treatment of local inflammation the relief of tension is an all-important point of practice to be followed, and that the means which in any individual case can best fulfil this object will be the right ones to adopt. In some cases the relief may be brought about or helped by position, in others by pressure. In acute cases it is only to be efficiently produced by a puncture, incision, drill, or trephine into the tense tissues or cavities; whereas, when the soft and elastic structures of the body are the seat of trouble, local venesection, cupping, or the application of leeches may suffice and it would be well if such means were more frequently employed. But wherever tension may be found, and in whatever tissue it may be situated, means must be employed for its relief; since, so long as it exists, the causes which led to it will probably continue, unless by the natural progress of the case tension becomes relieved by the destruction of the structures which are under its influence, or natural processes are sufficient to bring about a cure.

Where pain is present as an indication of the existence of

inflammatory tension, the surgeon has a guide of great value to help him to the right treatment of his case, and it is one which he should rightly use; although where pain is absent or but feebly expressed, there is the same necessity to relieve tension where it exists, for tension may be present even with distention without giving rise to pain; as, for example, in certain forms of peritoneal inflammation. In these cases, however, the same line of treatment is called for, and the same principle of practice is applicable as in others to which attention has been drawn; for, with an abdomen full of fluid, which is pressing in all directions upon veins, lymphatics, arteries, and viscera, with an embarrassed circulation, and an arrest of all physiological action of the organs implicated, how can any curative action be expected to take place? Let the distended abdominal cavity be relieved by the evacuation of its contents; let some or all of the inflammatory products which may retard repair be washed away and the circulation be disembarrassed; let the viscera be freed from all pressure, and the physiological action of all these important parts be allowed to have fair play, and then recovery may be brought within the bounds of possibility if not confidently anticipated. The good results which have followed the modern treatment of peritonitis by laparotomy and irrigation tend to support this view, and it is, I believe, by carrying out the principle I have feebly indicated that such successes are to be explained. In support of this view I would allude again to the partial withdrawal of fluid from tense cavities for the relief of tension, and the result which commonly follows the practice, for it cannot but be acknowledged that this action is often speedily followed by the absorption of the liquid which is left, and recovery from the local trouble. The partial withdrawal of pent-up fluids apparently so frees the venous, lymphatic and arterial circulation of parts which have by the pressure been previously embarrassed, as to be followed by their full physiological action and the progress of repair toward a cure. In many a large hæmatoma I have despaired of its absorption and a natural cure till I had withdrawn some of its serous contents and removed tension, when a rapid recovery followed.

In not a few inflamed knee-, hip-, and other joints made tense by inflammatory effusions, and so tense as to excite a fear of loss of structure, has a rapid recovery followed a care-

ful aspiration sufficient to relieve tension, or a subcutaneous puncture of the joint. Even in large abscesses, and particularly chronic abscesses, the same result may be chronicled, that is, the rapid absorption of what may have been left in the abscess cavity after the withdrawal of only a part. And the explanation of these results can probably be found in what has been already said.

I have thus, Mr. President, laid before you—although, I fear imperfectly—many, if not most, of the clinical data connected with what has been called tension, or centrifugal pressure. I have pointed out its causes and its effects, and more particularly the great value of pain as a significant sign of most forms of tension, and especially of inflammatory tension. I have attempted also to bring out from these facts a certain principle of practice, the value of which I do not think I have exaggerated. If I were to test the value of the practical principle I have brought before you by my own personal experience, I should place it very high, for I can assure you that I have for years acted upon it and not found it wanting. To carry it out fully, we must, however, return to former lines of treatment, and employ more frequently than we do the practice of leeching in local and comparatively superficial inflammations, and of puncturing, incising, drilling, and trephining in bony and subfascial inflammations; and these means should be employed early in every case. Should we employ counter-irritation, we shall do so on a kind of principle which is intelligible, and we shall therefore be more likely to employ our measures with success. To illustrate, however, what I have said to-day more fully and completely, I must go to the diseases of the bones and periosteum; and it is to these that I hope to draw your attention in my next lecture.

LECTURE II.

ON THE EFFECTS OF TENSION, AS ILLUSTRATED IN INFLAMMATION OF BONE AND ITS TREATMENT.

My last lecture was devoted to the subject of tension generally, and I trust I was able, with sufficient clearness, to satisfy you that tension of tissues has a widely spreading influence on the progress of disease, particularly of inflammatory disease. I pointed out what seemed to me very clear, that tension is a common factor of pain, and that in all inflammatory affections the pain of tension is not only a significant symptom of its presence, but a fair measure of its intensity. I showed how tension may and frequently does originate inflammatory action, more particularly in wounds, and that this effect takes place under every form of wound dressing. I demonstrated how in the soft tissues of the body, acute tension or tension acting at a high level, and allowed to take its course, always ends in the destruction of the tissues implicated; and pointed out that where tension was acting for any time at a low level in either hard or soft tissues, permanent change of structure, tending toward their destruction, may be looked for; and I concluded that the most satisfactory and certain method of arresting acute as well as chronic inflammatory processes is by relieving tension.

In my present lecture I hope to enforce all these conclusions by considering the effects of tension in bone when in a state of inflammation, and I do so in the belief that it is in the inflammation of bone and its fibrous covering that the effects as well as the treatment are best illustrated. The key to this conclusion is probably to be found in the vascular supply to the bone, and it will therefore be well to devote a few moments to its consideration. I have no intention, however, to weary you with any long anatomical description of bone and its covering. For our present purpose it is sufficient that we recognize the close vascular connection which exists between the

compact tissue of bone and its periosteal envelope, as well as the free anastomosis of the vessels which supply the medullary canal of bone with those of its compact substance. It is likewise important to keep in view that this vascular connection applies as much to its venous as to its arterial supply. The arrangement of the capillaries of the bone also must not be forgotten, for these pass through fine bony canals, which are incapable of dilatation or contraction, and flow into veins similarly arranged. The veins, moreover, have pouch-like dilatations or sinuses in their course, are deficient in muscular fibres and valves, and in all such internal arrangements and external surroundings as in the softer structures help toward the free circulation of the blood. In fact, the circulatory system in bones is so arranged as to favor blood stasis. With such anatomical arrangements it becomes, therefore, clearly intelligible why an inflammatory action which may have originated in one part of the bone—let us say in the endosteum—so soon involves the outside compact bone structures; why inflammation of the periosteum which envelops the bone is so frequently complicated with inflammation of the bone itself; and, last but not least, why when bone is inflamed and there is the necessary slowing of the blood current through the capillaries and veins of the inflamed parts, it is as rare as it must be difficult for natural powers, unaided by art, to bring about a cure. Thus it is, therefore, that we find, when acute inflammation attacks the periosteum, that death of the bone from extension of the inflammatory process is a common consequence; that acute inflammation of the medullary cavity of a bone (osteo-myelitis, endostitis, ostitis), as a rule, spreads to its compact walls, and ends in more or less destruction of the bone; and that, where this result does not follow, the formation of abscess or abscesses in the affected bone, with partial necrosis, is the termination to be expected. For when an acute inflammation has attacked a bone, whether as an extension from the periosteum or otherwise, its termination may be either in necrosis, partial or complete, or in the formation of an acute abscess or abscesses; the abscess cavity containing not only pus with the molecularly destroyed bone tissue, but as often as not a distinct sequestrum; for molar and molecular death of tissue with suppuration are the common results of acute inflammation of bone as of softer structures.

If we pass on to consider the effects of *chronic inflammation of bone*, the same want of recovery by resolution has to be recorded, with the same tendency for the inflammatory action to bring about destructive changes. An inflammatory process, once started, goes on slowly but surely, although possibly with intervals of relief and exacerbations; but it ends either in some abscess in the bone, the death of a small portion of bone with the condensation of more, or the sclerosing of the whole bone. Examples of all these terminations are both numerous and good in our own and other museums. It may be added, however, that where sclerosis of bone is met with, there is usually some degree of destruction of bone associated with it, either in the shape of limited necrosis or abscess; and I have reason to believe that if all apparently merely sclerosed bones were carefully divided into sections, either a small necrosed sequestrum or chronic abscess in the bone would be very generally discovered, the sclerosing process being due to persistent irritation kept up by the abscess or sequestrum. I have frequently myself found this, and consequently acted upon the knowledge, and I may add with advantage. In a case to be recorded later on, this fact is well illustrated, and in another case under Mr. Cock, which took place in 1856, in which the limb of a man, aged thirty seven, was amputated high up in the thigh for enormous enlargement of the femur of many years' standing, and in which the bone was like ivory, a very small piece of necrosed bone was found in its central canal, unattended by any external suppuration.

To find a full explanation of this fact—that inflamed bone and its periosteal covering, as a rule, ends in some destructive change—we must go to tension, for by universal consent surgeons acknowledge that the death of an acutely inflamed bone is brought about by such a cause, and also, that the intense pain which is connected with it, is without doubt, due to the inability of the bone tissue to yield in any degree to the distending influence of inflammatory hyperæmia and its consequences. And I trust I may find many to share with me the belief that it is this same tension in subacute and chronic inflammation of bone which not only keeps up the process and prevents recovery by resolution from taking place, but also tends to bring about the destructive and sclerosing changes in bone with which

we are all familiar. Why it is that, in bone, tension in any of its degrees is so fruitful of harm, must be explained by the anatomical facts relating to its circulation to which I have drawn your attention, and the difficulty under which unaided natural processes must consequently labor to enable the circulation of the bone to overcome the tendency to capillary blood stasis which forms the essential pathological phenomenon of inflammation, and upon which the life or death of the bone depends. For in bone, as there are neither in the normal arrangement of its capillaries and veins, nor in its surroundings, any such provisions as are found in soft tissues to favor the flow of blood in its usual physiological condition, so under the influence of disease, and more particularly of inflammation, in which the slowing of the blood current and capillary blood stasis are the invariable consequences, the difficulty of restoring the circulation to its normal condition must of necessity be infinitely greater. Under these circumstances the practical inference to be drawn is this—that it is the surgeon's duty, without reserve, when inflammation of bone and its covering can be made out to exist, to do what lies in his art to relieve tension; and it will be my object in this lecture to enforce this view.

As a preliminary point of great importance, however, I would draw your attention to the value of pain as an indication of the presence of inflammation of bone, such pain appearing to me to be the result of tension under all circumstances. In acute disease this is admitted by universal consent, and in the more chronic forms it has a no less general influence. The pain in its nature may not always be severe, or in the bulk of cases capable of being described as more than an ache, but this ache will probably at times be intensified by walking if the trouble be in the lower extremity, or by hanging the arm down during the day if in the upper limb—by anything, in fact, that helps blood stasis in the part. It is also, always, worse at night, when the circulation of the blood through the part with that of the body generally is encouraged by the warmth of bed; indeed, at these times the pain may be severe —very severe. Such pains in bone, increased at night, have been commonly believed to be associated with syphilis, and have been called osteo-copic pains. Such a conclusion may, however, be wrong. The pains, nevertheless, are always bone

pains, and as a rule due to inflammation. Occasionally, indeed generally, there is increased local heat in the bone affected, although in deeply placed bones there may be a difficulty in detecting it. In such a bone as the tibia the increased heat which is present is very marked if rightly tested; and what I man by the term "rightly" is as follows. The limb should be exposed with its fellow for purposes of comparison, and the palm of the surgeon's hand placed—if the suspected inflamed bone be the tibia—above the knee-joint, and allowed to rest there for a few seconds to appreciate the normal temperature. The hand should then be passed *slowly* downward over the suspected bone, say, to the ankle; and during this action any increase in local temperature, even if localized to the space of half-a-crown or less, may be at once detected. The sound limb should then be examined in the same way, and the sensations acquired by the two hands compared. The test takes less time to make than it has taken me to describe. It is far better than simply grasping the suspected bone with one hand and the sound one with the other, the method in which the examination is usually conducted. By the same method, even if the femur be the bone affected, the increase in temperature can be detected. I trust I may be pardoned for this digression. I have, however, no desire to enter into the diagnosis of these cases generally, and have dwelt upon the diagnostic value of pain more to draw your attention to its use as indicating the presence of inflammatory tension in bone than for any other purpose, for my object is to show you that this tension must be relieved, if any help toward cure can be entertained. To a certain extent most surgeons recognize the truth of these remarks, and more particularly in their treatment of acute periosteal inflammation. For they not only act upon the principle I am anxious to enforce, but also teach their pupils to make an incision down to bone as soon as the diagnosis of acute periostitis is sufficiently definite. This incision is called for primarily with a view of relieving subperiosteal tension and the hyperæmia of the probably involved bone; and secondarily, in oder to guard against the dangers, which should always be recognized, of the inflammatory effusions burrowing beneath the periosteal coverings of the epiphyses, or through the epiphyses themselves into the neighboring joints, and so originating a suppurative synovitis. No words

that I can use would be too strong to support this practice, for it is without doubt the only reasonable one.

When acute ostitis, endostitis, or osteo-myelitis attacks the shaft of a long bone, and still more when it originates in the juxta-epiphyseal cartilage or in the epiphysis itself, the necessity of making a free external incision is likewise a fairly well recognized practice. It is here adopted for the same reasons as have rendered it necessary in acute periosteal inflammations; but in these cases it should be regarded as a means only to a more important end—that is, to give room for the surgeon to relieve the tension in the bone itself, either by drilling, trephining, or otherwise freely exposing the centre of the bone in which the inflammation originated, or to which it may have spread. This operation is doubtless the only one which acts favorably upon the disease, in either arresting its course or limiting its destructive tendencies. But I would wish to go a step farther and urge that active local means to relieve tension should, as a principle of practice, always be immediately taken when such has been brought about by acute inflammatory processes, whether the periosteum or endosteum be its primary seat; and that the surgeon need not, before he acts upon this principle, wait, and in so doing lose valuable time, while a definite or exact diagnosis is being made. Indeed, in a clinical point of view, acute periostitis and endostitis had better be regarded as identical affections, since in both there is, pathologically, rapid effusion and extreme tension of tissue, which very quickly bring about its death, and, clinically, deep swelling, severe local pain, and marked constitutional disturbance. The general symptoms are frequently so severe as to raise the suspicion of the patient being the subject of an acute general rheumatic rather than of an acute local affection, as proved by the fact that in hospital practice many of these cases are primarily admitted into the physicians' rather than the surgeons' wards. Should joint symptoms coexist with acute epiphyseal inflammation, or follow diaphyseal ostitis as a result of burrowing of the inflammatory fluids beneath the periosteum into the joint, the surgeon should act more energetically, and he need not despair of seeing the joint symptoms disappear if relief can be afforded to the inflammation in the bone and a vent given to inflammatory products. If the joint has not suppurated, a perfect recovery

may be anticipated; but if this consequence has ensued, a recovery with ankylosis should be expected. The surgeon should remember that the destructive effects of tension in acute periostitis or endostitis is in most cases worked out within a week from the onset of the inflammation, so that, if good is to be gained by treatment, it is all-important that such should be applied early. He should likewise recognize the fact that by drilling or trephining inflamed bone necrosis is not produced; the operation may fail in preventing such a result taking place, but it will invariably tend toward its prevention and limitation. The incision down to bone in acute inflammation of the periosteum cannot be made too early; and in acute ostitis the same incision made as a preliminary measure to enable the surgeon to drill, trephine, or lay open the bone cavity itself, should evidence of its inflammation be present, can only tend toward good. If the periosteal incision be made in the early stage, in which blood-stained serum or blood alone is effused beneath the periosteum, the surgeon may entertain a reasonable hope that recovery will take place without necrosis; but if pus be present the chances are that more or less death of bone will ensue. In exceptional cases, however, a better result may be obtained. The following case of hemorrhagic acute periostitis very forcibly illustrates all these points, with others, and is consequently worthy of attention.

Case X.—A boy aged nine came under my care in November, 1876, with symptoms of acute inflammation of the bones of the left leg and ankle, as indicated by great swelling, redness, and tension of the soft tissues over the bones, and intense pain in the part. His temperature was 104°, pulse 140. These symptoms were said to have followed a kick received three days previously. As soon as I saw him a free incision was made over the fibula, where the tension seemed to be the greatest, and the periosteum was opened with a distinct explosive sound, the fluid from beneath being scattered in all directions. This fluid was, however, pure blood, clots being subsequently syringed or washed away. The bone was completely stripped of its periosteal covering. Two months later a large piece of necrosed bone exfoliated and was removed from the fibula, and the limb recovered. On the fourth day after the boy's admission into the hospital with acute periostitis of the left fibula, which had been attributed to a kick, the right leg became affected in precisely the same way; the tem-

perature rose to 102.6°; the pulse to 144. The affection was treated by a free incision over the fibula, as in the other limb, but within twenty-four hours of the onset of the symptoms, and blood escaped with the same explosive sound as on the former occasion from beneath the periosteum, and the bone was left freely exposed. No necrosis, however, ensued. Five days after his admission it was evident that the periosteum of the tibia of the right leg was involved with the fibula, and an incision was made directly down to the bone, from which pus freely escaped. The local and constitutional symptoms at once subsided, but necrosis of the tibia subsequently followed, and a sequestrum was removed at the end of two months. A good recovery afterward took place. In this case it is worthy of note that in the acute inflammation of the periosteum of the fibula, which came on while the boy was in bed, and was treated within twenty-four hours of the onset of symptoms by a deep incision, no necrosis followed. In the opposite limb, where the same trouble attacked the same bone and the incision was not made till the third day, necrosis ensued; and in the tibia, where suppuration was allowed to take place before the tension was relieved, the same result had to be recorded. The fluid that was effused beneath the periosteum of both fibulæ was blood, and in both limbs the tension of the periosteum was so great that its incision was attended with an explosive sound. No better case could be brought before you to illustrate the value of an early and free relief of local tension than the one I have briefly read, and certainly no better example could illustrate the benefit of action and early treatment in checking and limiting disease.

In the following two cases the periosteal incision was not made until suppuration had occurred; but in neither of them did necrosis follow. Such a possibility is consequently a strong inducement for the surgeon to interfere, even in cases which are unpromising.

Case XI.—A boy aged ten (David K——) came under my care in July, 1877, with his left thigh and knee-joint enormously swollen, tense, and tender. He was also in a state of high fever, with a temperature of 101.2°. The local trouble had come on two days previously, with pain and swelling, and this had followed a fall upon the knee two days earlier. The diagnosis made was acute femoral periostitis, with effusion into the knee-joint from contiguity. An incision was therefore made into the outer side of the thigh, between the tendon of the biceps and ilio-tibial fascial band, down to the femur, when six or more ounces of pus escaped, the femur being found stripped of its periosteal covering for some inches. The abscess cavity was washed out and drained. Great and immediate relief fol-

lowed this operation, and a steady convalescence in about six weeks. There was no dead bone as a result of the inflammation, although pus had formed in two days from the origin of the trouble.

CASE XII.—In this case a like favorable result took place. A boy aged four (W. P——) came under my care in 1876, with a deep-seated, tender, and painful swelling involving the centre of the left femur, which had speedily followed a fall downstairs nineteen days previously. Pain and swelling had appeared a day or so after the fall; but for a week the child limped about, although he was ill. When I saw him a deep periosteal abscess evidently existed, which I laid open, evacuating pus and exposing bone. Rapid recovery ensued, and without loss of tissue.

If I am not wearying you, I should like to quote the leading facts of other cases, in which acute inflammation attacked the epiphyses of bone, or the diaphyseal cartilage; in which by a like treatment good results were secured.

CASE XIII. *Acute Necrosis of the Head of the Tibia, with Inflammation of the Joint; Opening of the Abscess in the Bone, and Removal of a Sequestrum; Rapid Recovery.*—Robert G——, aged nine, came under my care at Guy's Hospital on October 4th, 1887, with acute periostitis or ostitis of the head of the left tibia, which had followed closely upon a blow he had received when running seven days previously in a fall upon the knee against a curbstone. The accident was followed by pain, which became severe on the second day, when swelling appeared. He could not then walk. When admitted on the fifth day of the symptoms, there was effusion into the knee-joint, extreme pain on movement, and tenderness, but no fluctuation over the head of the tibia. His temperature was 102.6°. An incision was at once made down to the bone, but blood alone escaped. This operation, however, gave relief, but only for a time. Consequently a second incision was made on the inner side of the bone, and later on others, for diffused suppuration took place all round the head of the bone, which suggested more than the possibility that an abscess existed in the bone with more or less necrosis. On January 1st the bone was consequently explored by means of an incision and chisel, and a large cavity in the head of the tibia exposed, in which rested a sequestrum. This was then removed, and the cavity well cleansed with sponges dipped in hot iodine water. The bone left seemed to be a mere shell, the *upper surface of which formed the articular facet of the joint.* The cavity in the bone was then allowed to fill with blood, and iodoform dressing was applied over the wound, with a sponge as a pad and the whole limb was fixed on a posterior splint. All con-

stitutional symptoms rapidly disappeared after this operation. The wound quickly filled up, and in six weeks the boy was practically well. In another three weeks he was allowed to move the knee, when the movements became natural. By the end of March he was quite well, and left the hospital with a perfectly movable knee-joint. In this case an earlier exploration of the bone should doubtless have been made. Such a measure would probably have limited the disease, and would certainly have saved pain.

CASE XIV. *Acute Abscess, with Necrosis in the Head of the Tibia; free Incision into the Bone; Removal of Sequestrum; Recovery.*—George H——, aged fifteen, a healthy boy, came under my care in July, 1875, with a tensely swollen and inflamed left leg below the knee, and a discharging sinus over the inner tuberosity of the tibia. The boy was in great pain, and was very ill with high fever. The swelling had been present for three weeks, and had followed a blow below the knee. An abscess over the head of the tibia had been opened two days previously. As there was not sufficient drainage for the abscess, a free incision was at once made over the head of the tibia, and the parts were irrigated. A fistulous opening was then discovered leading into the bone; this was at once enlarged, when a cavity in the head of the bone the size of a walnut and lined with membrane, was exposed. The cavity contained a rounded sequestrum, which was removed, while the cavity of the abscess was cleansed. After this procedure rapid recovery ensued, and the boy left the hospital on August 30th, well, with a sound limb and movable knee-joint.

The following cases, kindly furnished to me by my colleague, Mr. Davies-Colley, further illustrate this point.

CASE XV. *Drilling for Acute Necrosis of Tibia; Suppuration of Knee-joint; Incision into Joint; Recovery, with Movable Knee.*—Percy C. C——, aged nearly four, was admitted into Guy's Hospital on March 16th, 1885, with acute inflammation of the right tibia. On the 11th his leg had begun to be painful. His father said that no cause was known, but on a subsequent occasion he told us the boy had had a fall the same day or a day or two before, and that he had some fits before the knee pain began. On admission the boy's temperature was 102.8°. Fluctuation was felt over the whole of the subcutaneous portion of the right tibia. Free incisions were made down to the bone, which was found to be nearly all bare, and was drilled in four places, whence pus welled out. On April 27th the patient's temperature was 105°. On the 30th of that month the right knee-joint was swollen and fluctuating. Free incisions into the joint were made, giving exit to thick curdy pus. At the same time the whole of the anterior part of the

diaphysis of the tibia was removed. The boy recovered, with a perfectly movable knee-joint.

Case XVI. *Acute Necrosis of the Lower Half of the Tibia: Suppuration of the Ankle-joint; Drilling of Bone and Incision into Joint: Recovery.*—Fred. D——, aged sixteen, was admitted on May 12th, 1882. He had been a little out of sorts; had fallen and hurt his left ankle. Œdema of the leg and high temperature followed. On May 18th a free incision was made down to the tibia in its lower third; the ankle-joint, which was suppurating, was also opened. On May 23d the temperature, which had at first fallen, had again risen; and the patient had had some vomiting. Some swelling was found just below the tubercle of the tibia. Ether was again administered, and pus evacuated by a free incision. The bone was then drilled, when two or three drops of pus oozed out from the drill holes. From the fact that the second periosteal abscess was separated from the first by apparently healthy bone, Mr. Davies-Colley thought that the disease had extended from one part of the bone to the other by suppuration along the medullary cavity, and that it was desirable to give exit to the pent-up pus. After necrosis of nearly the whole shaft, the boy went out quite well, with a stiff ankle. Mr. Davies-Colley remarks: "If I had drilled when I cut down upon the lower third of the limb, I might have prevented the extensive necrosis. So I determined in future cases to drill earlier."

Case XVII. *Subacute Inflammation of the Tibia; Incision down to the Bone; Abscess in the Bone; Subsequent Recovery.*—Martha F——, aged fourteen, was admitted on July 16th, 1882. She had injured her left ankle a week previously. There was swelling of the ankle and over the lower half of the leg, and semi-fluctuation over the tibia. A free incision was made, but only serum came away; the periosteum was not separated. On September 22d a sinus was still left. An incision was then made down to the bone, which was found to be enlarged, and converted into a cavity containing pus, lymph, and small sequestra, which had to be scraped away. The patient was discharged convalescent on November 21st, 1882.

Of the foregoing case Mr. Davies-Colley remarks: "If I had drilled at the first operation I should very likely have saved her a long illness and some danger."

If this practice were carried out systematically in all cases of acute inflammation of bone and its covering, I do not believe we should hear so much as we do of subperiosteal resection of the shafts of inflamed bones—an operation I have never done, nor seen to be needed; and amputation for acute endostitis would only be called for in neglected cases, or where joint

complication rendered any partial measure impossible. At any rate, it may be safely said that the necessity for either of these severe measures would rarely occur. In any local periosteal inflammation, in which symptoms are less severe than in the cases quoted, the same principle of practice is equally applicable, and, it may be added, beneficial. Thus in my own practice I have, with invariable advantage, in not a few examples of local periostitis, where local pain was a serious symptom, made a free subcutaneous incision down to the bone through the inflamed periosteum by means of a tenotomy knife carefully introduced through a valvular opening in the skin; the incision not only relieved tension, the cause of pain, but at the same time checked inflammatory action. Where this little operation is done early, before suppuration has taken place or the vitality of the bone has been jeopardized, a rapid recovery may be looked for; and where more serious structural changes have taken place, pain is relieved, and, there is reason to believe, the destructive changes are limited. In the local periostitis or ostitis of a cranial bone, with or without fracture, this detail of practice cannot be too speedily carried out; but in these cases an open incision is probably to be preferred. In the following case the benefit of the treatment was well exemplified.

Case XVIII.—*Periostitis of both Tibiæ after Typhoid Fever; Suppuration of one Limb and Necrosis; Subcutaneous Division of the Periosteum of the other; Recovery.*—In March, 1865, I was consulted by Mr. B——, aged twenty-six, for some great thickening of the shafts of both tibiæ, which had appeared seven weeks previously when he was recovering from typhoid fever. There was much pain in both limbs, and in the right apparently suppuration, but not in the left, which was hard to the touch and very painful. The swelling over the right tibia was laid open by a free incision, and pus evacuated, the bone beneath being evidently necrosed. The swelling on the left limb was divided subcutaneously down to the bone by means of a long tenotomy knife; blood alone escaped. Pain was at once relieved, and did not return; and a rapid recovery took place. In the right limb some dead bone was eventually removed, and recovery followed.

Having thus far considered the effects of tension acting at a high level in acute inflammation of the periosteum and bone, and dwelt upon the principle of practice which should be acted

upon for its relief, with the best means of carrying it out, I propose now to pass on and consider the effects of tension in the more chronic and subacute affections of the same structures; and trust that I may be able to convince you that it is by acting upon the same practical principle that the best hope can be entertained of arresting the inflammatory action and of placing the inflamed part in the most favorable condition for repair. To allow these cases to take their course, every surgeon will admit, is most unsatisfactory; for their course is a long one, often for years; and they commonly, if not invariably, end in either local suppuration, local necrosis, or sclerosis of bone, but rarely in recovery by resolution; and in any individual case one or more of these results may be found together. The preparations before me demonstrate the truth of these remarks. The object of the surgeon in the treatment of these cases should therefore be to anticipate these organic changes, and prevent them where he can. Attempts to do this by medicinal and local measures, other than operative, are neither hopeful nor successful, although the value of the iodides and of mercury in certain cases must be recognized; and I feel confident that the only sound principle of practice which should be carried out in examples of chronic ostitis is the one based on the relief of tension, as indicated by pain. To illustrate my meaning better, let me place before you a typical and not uncommon case. A surgeon has before him a patient, usually a child or young adult, who complains of a dull, aching, stubborn pain, localized in the shaft, or more commonly in the extremity of a long bone. The pain has probably existed off and on for months, or possibly for years, and it is to a degree constant; it tends, as John Hunter expressed it, "rather to produce sickness than to rouse." After exercise, or use of the affected limb, the pain is intensified, sometimes to a high degree, and at night, when the patient is warm in bed, it is to a certainty aggravated. In the subacute cases fever or febrile disturbance may exist; in the more chronic cases it is rarely met with. On local examination, there is probably, if the affection has been of some standing, an enlargement of the bone, and on passing the palm of the hand from above downward over the seat of mischief an increase of temperature is to be detected. Firm local pressure recognizes in some cases a tender spot, while in others local

percussion through the surgeon's finger elicits pain. There may or may not have been a history of some local injury months or years previously. There may or may not be some general symptoms; as a rule, the general symptoms are conspicuous by their absence. In such a case as this the only diagnosis that can be made is one of inflammation of the bone, which has been persistent and progressive; but whether the case be one of osteo-myelitis of the articular extremity of the bone, as one author might like to call it, or of rarefying osteitis, as modern authorities would describe it, is of small importance. In simple pathological language, the case is one of inflammation of the shaft of the bone, or of the cancellous bone situated at the epiphyseal extremity of the diaphysis (juxta-epiphyseal ostitis), or of the epiphysis itself, which experience tells us in no uncertain tone, if it be allowed to continue, will end in some destructive change, with more or less condensation of bone structure. What change the bone may have undergone at the time when it came under observation must be a dark point, and one quite beyond the power of the surgeon to diagnose with any certainty. There is happily, however, no great necessity for the surgeon before he acts to form any very definite diagnosis upon these points. He need do no more than recognize the presence of inflammation in the bone, and of tension as indicated by pain, to induce him to take steps for its relief; and a very little experience will prove to him that by the relief of tension in the bone, wherever it may be found, pain will be relieved, if not made to disappear, and with its amelioration the inflammatory process will probably subside. Under the circumstances now being considered, I should at once make an incision down to the bone through the periosteum, and perforate the bone with a drill, well into its centre in one or more points, according to the extent of bone involved; and I should do this with the object of relieving tension in the bone. If blood alone or serum escaped from the punctured wound, I should conclude that no destructive changes had taken place in the bone, and consequently I should do no more, in the confidence that the simple operation I had performed would, in all probability, be followed by the immediate and permanent loss of pain—which, it is to be remembered, is the measure of tension—and by the cure of the disease by resolution. Should, however, the local pain persist

after this operation, I should drill again; and if this measure proved unsuccessful, I should infer that in all probability some abscess cavity is present which must be sought for. The trephine under these circumstances would be the right instrument to employ with the drill as a bone-searcher introduced through the trephine excavation. Should pus or puriform fluid escape from the drill opening made in my first exploration, I should have recourse at once to the use of the trephine, cutting forceps, saw, or chisel, with the view, not only of making room for a full exploration of the abscess cavity, but also for the removal of any sequestrum which might be present in the cavity; and last, but not least, the cavity itself should be thoroughly wiped out and cleared of all lymph, caseating pus or old inflammatory material, which if left would do harm. In subacute and chronic ostitis, the single inducement which should lead the surgeon to interfere is deep-seated pain, and particularly nocturnal pain; for the pain not only clearly indicates tension of the inflamed tissues, but also suggests steady progress of the trouble. All experience shows that in these cases, inflammation continues until relief to tension be found either by the destructive processes of the disease itself or by the surgeon's art. The following brief notes of cases well illustrate the practice I have sketched out, with its results.

Case XIX. *Ostitis of the Head of the Tibia Cured by Drilling.*—George S——, aged thirty, came into my hands for treatment on April 5th, 1871, with great enlargement of the head of the left tibia. The trouble had appeared about four months previously, with pain, and it had followed a blow. The pain was constant, and of a dull aching kind; it was far worse at night. The knee-joint was unaffected, and the soft parts over the bone appeared to be natural. There was no history of syphilis. The diagnosis of ostitis having been arrived at, I made an incision down to the bone, and in so doing found the periosteum much thickened. I then drilled the head of the tibia in two places, and from the openings in the bone blood alone escaped. The operation was followed by immediate relief, and pain did not return. The bone gradually diminished in size. The wound healed kindly in a month, and the man left the hospital well in six weeks. Some months later he was at work with a sound limb.

Case XX. *Abscess in the Shaft of the Fibula, Drilled and then Trephined; Cure.*—Frank R——, aged twenty-eight, a healthy commercial traveller, who had never had syphilis,

came into Guy's under my care in January, 1885, with a hard, painful swelling over the centre of his right fibula, and some œdema of the foot and parts around. There was locally increased heat. The swelling had been gradually coming on for four months, and it appeared with pain. The pain had been constant since, although it was worse at times, and invariably so at night. On several occasions he had had to lie by, and for three months had gone about on crutches. An incision was made down to the fibula through the peronei muscles, which were found to be infiltrated with inflammatory material. The periosteum over the bone was thickened. I drilled the bone in two places, and from each opening pus exuded. I consequently trephined the bone, and exposed a cavity from which at least an ounce of pus escaped. There was no sequestrum in the cavity. The cavity was washed out with iodine water, cleaned thoroughly with sponge, and dressed with iodoform gauze, etc., and within six weeks the man was well.

Case XXI. *Abscess in the Head of the Tibia Following a Blow, which Discharged into the Popliteal Space; Free Opening into the Bone; Recovery.*—Robert J——, aged forty-three, came under my care in July, 1869, with his left leg flexed upon his thigh, a discharging sinus in the popliteal space, and marked expansion of the head of the left tibia. There was constant pain in the bone, and three inches below the knee firm pressure could not be borne. Twenty-five years previously he had had ostitis of the tibia, followed by the exfoliation of bone six months later and recovery. He remained well for twenty years, when he received a blow upon the inner side of his knee, which was followed by a popliteal abscess. For the previous nine months his leg had been gradually becoming flexed upon the thigh. The case was regarded as one of abscess in the upper part of the tibia discharging into the popliteal space. Under these circumstances, the abscess in the bone was opened by means of a strong knife, the bone being thin, and about an inch of the abscess wall in the bone was removed. A large cavity was thus exposed, which extended upward toward the knee-joint. The cavity was lined with granulations, and contained pus, but no dead bone. It had evidently opened into the popliteal space. The cavity was well washed out, with the popliteal abscess. The knee was extended, and the whole limb fixed upon a posterior splint. The wound was dressed carefully with dry dressing. Subsequently repair went on uninterruptedly. The cavity in the bone filled up; all pain ceased; the popliteal abscess rapidly closed; and by August 12th—that is, five weeks after the operation—the man was convalescent and the wound had healed. A month later the cure was complete.

Case XXII. *Chronic Ostitis of the Distal Ends of the Tibia and Fibula, after a Compound Fracture of the Bones;*

Great Expansion of Bones; Drilling of Bones, with Rapid Recovery.—Herbert G——, aged twenty-four, came under my care on June 9th, 1886, with a compound comminuted fracture of the tibia and fibula, about four inches above the ankle joint. He did well after the accident, and left the hospital on August 6th, with a protective splint, convalescent. Four months later he returned, with great enlargement of the distal ends of the broken bones and much local pain, which was aggravated by exercise or pressure. There was likewise increase of heat in the part. The foot was raised and fixed upon a splint, and cold applied by means of Leiter's coil, with some benefit and relief to pain. He then left the hospital, but returned on February 7th worse than ever—that is, the bones were expanded and more painful, and the pain was worse at night. The general appearance of the ankle suggested the presence of some new growth. On March 4th, 1887, I made a free incision down to the tibia over the enlarged and inflamed bone, and then drilled the bone, when blood alone escaped from the wound. The operation was followed by immediate relief and the steady diminution of the swollen bone. On March 28th the same operation was performed upon the lower end of the fibula, with a like result. The man left the hospital, well, on May 5th, and reported himself three months later as quite well.

Case XXIII. *Ostitis and Central Abscess, following Fracture of the Shaft of the Humerus Twenty Years Before; Drilling and Trephining; Recovery.*—George W——, aged twenty-seven, was admitted into Guy's Hospital under Mr. Davies-Colley, in November, 1885, with pain in the lower part of the arm, thickening of the lower end of the shaft of the humerus, and a small sinus three inches above the olecranon. He had received a simple fracture of the humerus twenty years previously. For six years he had remained well; then, from time to time, there had been a discharge of spicula of dead bone. There was good movement of the elbow joint. On November 17th, the patient being etherized, Mr. Davies-Colley made an incision down on the back of the lower three inches of the humerus, which were thickened and rough. A small cloaca existed at the upper part of the olecranon fossa. The back of the humerus was drilled three inches up, where the sinus was, and where he had complained of much tenderness. A cylindrical abscess cavity was exposed and Mr. Davies-Colley removed by a trephine, etc., nearly all its posterior wall. It was three inches long by three quarters of an inch in diameter, and communicated with the small cloaca in the olecranon fossa. There was no sequestrum in it. He recovered rapidly.

This clearing of the abscess cavity after its evacuation, or the removal of a sequestrum, is best done by sponge. A piece of sponge on dressing forceps acts as a fine raspatory on a

bone cavity, and cleanses it more thoroughly of all inflammatory products and molecular fragments of necrosed bone, than anything else. It is far better than scraping or gouging the bone. The sponge I have dipped in hot iodine water before use. When the cavity has been well cleared out, and no foreign body in the shape of necrosed bone is left behind, a recovery with a good limb may be expected to result. After the operation described I leave the case much to nature, but take great care to keep the wound aseptic and the parts involved perfectly immovable. If the cavity fills up with blood-clot I do not disturb it, but keep its surface dusted with boracic acid and iodoform powder, and covered with a simple dressing of iodoform gauze dipped in terebene and oil. In the daily dressing, iodine water is employed to irrigate the wound. By these means I have had many cases in which the cavity rapidly filled up with granulation tissue, beneath and within the blood-clot, and subsequently cicatrized without any trouble; the presence of the blood-clot, kept aseptic, doubtless much helping—in ways I need not stop to consider—the growth and organization of granulation tissue. Some of these cases have been in subjects who were feeble, and who might have been called tuberculous, and yet in them repair went on as favorably as in the apparently more robust. Where with inflammation of the articular extremity of a bone—whether originating in an epiphysis, diaphysis, or intervening cartilage—the joint itself is implicated, the case has of necessity a far more serious aspect. And the fact should at once lead the surgeon to be more energetic in his treatment, rather than dilatory; for if the joint complication shows itself only as a subacute or chronic synovitis, such a complication may be expected to subside, if its cause, the bone inflammation, be relieved. In the following case the truth of these observations is well illustrated.

Case XXIV. *Chronic Ostitis of the Head of the Tibia, with Joint Symptoms; Drilling of Bone; Recovery.*—Henry R——, a master butcher, aged twenty-eight, came under my care in October, 1887, with some enlargement of the head of the right tibia, and a constant aching pain in the part. The pain had existed for *ten* years, having originated when he was eighteen, and had come on without any known cause. Every few months he had been quite incapacitated. At times the soft parts over the bone swelled, particularly after violent exercise. The pain likewise then became much aggravated, preventing sleep;

also, it was always worse at night. The knee joint had been stiff for some months, any attempt to flex it exciting pain. There as no history of syphilis. On admission, there was impaired movement in the knee joint, and some swelling. There was very evident enlargement of the head of the tibia, and more particularly about its inner tuberosity. The leg at this part measured nearly an inch more in circumference than its fellow. At one spot there was increased tenderness over the bone, and the soft parts covering it were slightly thickened. The diagnosis was chronic inflammation of the bone. I accordingly made an incision over the painful spot, and reflected a thickened periosteum. I then drilled the bone well into its centre. Blood alone escaped. I made only one puncture into the bone, as I was anxious to test its efficacy, but was prepared to do more should relief not be afforded. The wound, which I left as an open one, was dressed with care, and the limb fixed on a splint. Everything went on well. All pain ceased after the operation, never to return; and the wound healed in a month. At the end of that time the patient was allowed to move his knee, which he did without pain; and in another month he was quite well. At the present time (five months after the operation) he is well and at work, somewhat surprised at the rapid relief he obtained for a trouble he had had so long.

Case XXV. *Drilling for Chronic Ostitis; Recovery.*—G. A. T——, aged seventeen, was admitted to the hospital under the care of Mr. Davies-Colley, on Jan. 30th, 1884. He was a tall, thin youth, who had suffered pain in the lower end of the left tibia for two years. No cause for its origin was assigned. He was at first treated with iodide of potassium and perchloride of mercury, and with the local application of ung. hydrarg. co., but no improvement resulted. On April 30th, 1884, the tibia was drilled in eleven places to the depth of from half an inch to an inch. The bone was soft. Nothing but blood came away. On May 5th there was freedom from pain. On May 8th, as there was some pain at night, he was ordered a mixture of potassium iodide and the perchloride of mercury. On May 25th the patient was discharged cured. He had no pain and walked quite well.

Case XXVI. *Chronic Inflammation of the Upper Third of the Tibia following a Blow Three Months Previously; Drilling; Recovery.*—Henry T—, aged thirty, a carman, married, having three children, was admitted, under Mr. Davies-Colley, on March 22d, 1876, with the upper part of the right tibia swollen. There was no redness over it, but some tenderness. There was severe pain in the bone, which was worse when he set his foot to the ground. He suffered also at night from a pain of a "jerking" character, which woke him up. The swelling had come gradually after a kick from a horse re-

ceived three months before his admission. He had never had any venereal disease. He was kept in bed; ung. hydrarg. co. was applied, and iodide of potassium administered at first in three-grain and afterward in ten grain doses, three times a day. After three weeks he went out relieved; but he soon returned with the pain as bad as ever. He was again admitted on May 1st, 1876. On the 13th, an incision was made under an anæsthetic down to the tibia; and the bone was drilled with a gimlet. A week later, the wound was nearly healed and the pain had gone. The man left the hospital quite well on June 7th.

When an abscess has made its way into an articulation, the destruction of that joint is a general result, and under these circumstances amputation is often called for. To prevent this complication must ever, therefore, be a surgeon's great aim, and this can only be done either by checking the inflammatory action in the bone before suppuration and destructive changes have taken place, or by finding a vent for the external discharge of the abscess. The experience of every surgeon will supply abundant evidence of the truth of these remarks; and it would be well if we could say from the same experience that an equal number of cases could be quoted showing the advantages of early interference. Some few cases doubtless could be adduced; but I am disposed to think that too many are allowed to drift, and hopeless joint disease ensues, which has probably to be met by some trenchant operation.

Case XXVII. *Abscess and Necrosis of the Head of the Tibia after Typhoid Fever; Removal of Bone, including a Portion of the Articular Lamella of Bone forming the Knee-joint; Recovery, with a Good Joint.*—Ada M——, aged sixteen, came under my care in June, 1884, having within three months after recovery from typhoid fever—that is, seven months before admission into Guy's—had pain in the head of the left tibia, associated with swelling and high fever, which culminated in an abscess. This has been opened, and had discharged ever since. When seen there was much effusion into the knee-joint, and a sinus existed over the inner tuberosity of the tibia, which led into a cavity in the bone, and the leg measured at the level of the sinus an inch and a half more than its fellow. The bone was consequently at once trephined and a sequestrum removed, and, while the exposed cavity was being grasped, another abscess was opened nearer the joint. The sequestrum removed included a portion of the articular surface of the tibia. The head of the bone formed a mere shell. The cavity was well syringed out with warm iodine water and

dressed with iodoform gauze dipped in terebene, and the leg and knee were fixed upon a splint. When the dressings were removed on the second day, the cavity in the bone was found to be filled with blood-clot. Care was taken not to disturb this, but to keep it aseptic by washing its surface daily with iodine water, dusting it with boracic acid and iodoform powder, and dressing it as before. In six weeks the whole cavity had filled up with granulation tissue, the granulations having quietly taken the place of the blood-clot, which gradually disappeared. In another month the external wound had cicatrized, and there was movement in the joint. Six months later the limb was well and sound, with all its movements. The temperature of the patient during treatment never exceeded 99°.

Case XXVIII. *Acute Necrosis of the Shaft of the Tibia; with Suppuration of the Knee-joint; Perforation of the Epiphysis into the Articulation; Recovery with a Stiff Joint.*—Geo. H——, aged seven years, came under my care in May, 1879, with redness and great swelling of the upper part of the right leg and œdema of the foot. The child was in intense pain, and cried on the least movement. He had a temperature of 103°, and his pulse was 125. The pain and swelling had existed for three days, and had followed a knock upon his knee against the edge of a wall two days previously. The centre of the swelling and the pain seemed to be over the inner tuberosity of the tibia. The knee-joint was enlarged. I at once made an incision down to the bone at this spot and evacuated pus from beneath the periosteum, and this measure gave relief. The knee joint, however, suppurated, and had to be incised, irrigated, and drained on June 24th; that is, about six weeks later. During these weeks the acute symptoms subsided, but it was clear that extensive necrosis of the diaphysis of the tibia had taken place; and on August 7th I removed nearly the whole of the dead shaft of the bone. Having done so, I readily found an opening which had passed through the upper epiphysis of the tibia into the knee joint, thus explaining its suppuration. In about six months the child was well, with a stiff knee.

In hip disease, secondary to bone trouble, its most common cause, the value of the practice of tapping bone is well seen, and in the following two cases well demonstrated. In one, the bone trouble had not passed beyond the hyperæmic stage; in the second, an abscess had formed and was opened. In both, good results ensued.

Case XXIX. *Ostitis of the Trochanter and Inflammation of the Hip cured by Trephining the Bone.*—Walter S——, aged seventeen, who had enjoyed excellent health, came under my

care in July, 1875, with symptoms of hip disease. They had appeared seven weeks previously as pain in the left hip when he walked, but with absence of pain when he rested, except in bed, when the pain kept him awake. The pain steadily increased and became more constant, so that at last he could not stand. On admission, the thigh on the level of the great trochanter measured an inch and a half more than its fellow. The great trochanter was much enlarged, as if from its expansion, and pressure upon it excited pain. The soft parts over the bones looked natural, but to the hand felt hotter than those over the corresponding bone. Pain was produced by movement of the bone, and on pressure into the joint behind the trochanter. I looked upon the case as one of chronic inflammation of the great trochanter and neck of the femur, with inflammation of the hip-joint from its contiguity, and I advocated tapping the bone. This I did on August 20th. I first made an incision three inches long over the trochanter down to the bone and peeled off some thickened periosteum. I then trephined the bone, which I found soft and very vascular. Through the trephined orifice I then drilled the bone in four directions; no pus, only blood, escaped. The wound was dressed in my usual way, and the limb fixed in a double splint. No bad symptoms followed this operation. The patient lost his pain from the date specified, his joint symptoms subsided, and the wound healed in three weeks. He left the hospital convalescent, and when seen by me some six months later he was quite well, though his hip was stiff.

Case XXX. *Hip Disease, with Expansion of the Great Trochanter from Ostitis; Drilling of Bone, without Benefit; Trephining; Opening an Abscess in the Bone; Cure.*—A man aged forty-five came under my care in October, 1876, for hip disease of seven years' standing. He had, however, been able to get about, although with pain. Six months before coming under my care he became much worse, and was obliged to remain in bed. For some months the hip had enlarged. When admitted to the hospital his right hip was swollen, and the limb was shortened and adducted. The great trochanter was much enlarged. Movement of the limb caused pain, but the head of the femur moved smoothly in the acetabulum. Pressure over the trochanter could not be tolerated. The pain in the hip was worse at night. On October 24th the great trochanter, which was so much enlarged, was cut down upon and drilled in six places. Blood alone escaped. The bone felt soft, and was clearly vascular. No relief, but no harm, followed this operation. Consequently, on the 27th I trephined the bone, and dropped into a cavity containing lymph and pus. This was well cleared out, and its walls gouged. From this time all pain and bad symptoms disappeared, and the wound granulated. On February 28th the limb was abducted from

its position of adduction, and fixed on a double splint; and by April the man was well. Three months later he could walk upon the limb without pain, although the movements of the joint were not complete.

The practice inculcated by the last two cases might, I think, be repeated more frequently with advantage.

Chronic circumscribed abscesses in bone are to be diagnosed or suspected by the presence of the same symptoms as have been given under the heading of chronic inflammation of bone generally. They are, however, often met with after many years of symptoms. In Brodie's two celebrated cases there had clearly been local evidence of bone disease for ten or twelve years respectively, about half the patient's life. These abscesses are, moreover, found in the epiphyseal extremity of a diaphysis, or in an epiphysis (a rare position). The pain of a chronic abscess in bone is, in exceptional cases, very slight; more often it is severe; it is, as other bone pain, paroxysmal and worse at night. One patient described it to me, when it was at its worst, as being "like the falling of drops of molten lead.' Others describe it as a toothache pain or throbbing pain, or like the ticking of a clock. With these symptoms, abscess may with confidence be diagnosed. An abscess may appear as a direct result of inflammation, but as often as not it is consecutive to some antecedent action, to some ostitis which had been treated and regarded as cured. It is, under these circumstances, due to the breaking down—caseation—of some old inflammatory products which nature's processes had failed to absorb or utilize: and it should therefore be regarded as a residual abscess in a bone, since it is analogous to such as are found in the soft parts, and particularly about joints.

Brodie, without doubt, was the first surgical author who, by his papers of 1845 (Lond. Med. Gaz., Dec. 12th, 1845, p. 1399) and 1846 (Med.-Chir. Transac., 1846), caught the ear of the profession of his time, and led his contemporaries as well as those who followed, to look upon such cases as a novelty, and the practice indicated as an innovation. So much so was this the case that Sir W. Ferguson, in 1864, in his lectures from this chair, described "the memorable instance in which Brodie amputated a leg for incurable pain in the tibia as one of the beacon lights of surgery never to be forgotten. It was, if I mistake not," he added, "the model case on

which all our modern ideas about abscess of bone are founded, and the pathological examination of that limb led to a line of practice of inestimable value, which even at the present day (1864) is, I imagine, scarcely appreciated at its full worth." ("Lectures on Progress of Surgery," p. 35.) Yet on looking into the subject, William Broomfield, a surgeon to St. George's Hospital, where Brodie was educated, wrote in 1773: "Whenever a patient complains of a dull, heavy pain, deeply situated *in* the bone, possibly consequent to a violent blow received on the part some time before, and though, at the time the patient complains of this uneasiness within the bone, the integuments shall appear perfectly sound, and the bone itself not in the least injured, *we have great reason to suspect an abscess in the bone.*" ("Chirurgical Observations.") And John Hunter himself, who lectured on surgery at St. George's Hospital, when speaking of abscess in bone in 1787, said in one of his lectures: "The crown of the trephine is often necessary to be employed in order to get at the seat of abscess;" and he spoke as if the practice Brodie advocated later on was well recognized in his day—as, doubtless, it was. Brodie, at any rate, had forgotten it, and he did good in recalling the attention of surgeons to the subject. Brodie, however, went a step further than any other surgeon of his day, for he not only recognized the value of using the trephine when an abscess existed in bone, but he suggested the possibility of the practice being of use for the very purpose I am now advocating—the relief of tension; and he did so in the following words: "Even if abscess should not exist, I can conceive that the perforation of the bone, *by relieving tension and giving exit to serum collected in the cancellous structure, might be productive of benefit;* and at all events, the operation is simple, easily performed, and cannot itself be regarded as in any degree dangerous." (Brodie on "Joints," third edition, 1850, p. 298.) I am pleased, therefore, to be able to bring forward such a surgeon as Brodie to support me in the practice I am now advocating.

Case XXXI. *Chronic Abscess in the Lower End of the Ulna, of Eight Years' Duration; Trephining; Removal of a small Sequestrum from the Abscess Cavity; Complete Recovery.*—Emma R——, aged twenty-five, a healthy married woman, came under my care in November, 1881, with an enlarge-

ment of the lower two inches of her right ulna, which had been slowly coming for eight years. The affection had followed a sprain. Pain, of a dull, aching character, had followed the sprain and this had at times been felt up to the arm. When seen, the bone in its lower two inches was at least twice its normal size. The swelling was smooth, and to the touch painless; all the movements of the hand were natural. There was a constant dull aching pain in the part, and at times the pain was intense. The diagnosis made was that of chronic inflammation. In December I cut down upon the bone, and peeled back the periosteum, which was healthy. I then trephined the ulna, and found great difficulty in doing so on account of the density of the bone. Having removed a cylinder of bone, I exposed a cavity about three quarters of an inch in diameter, in which rested a small round sequestrum of bone, surrounded with pus. The wall of the cavity was made up of dense bone. After the operation all pain ceased, and a good recovery followed. When seen by me five years later, the hand and arm were as good as the other, except for the scar.

Case XXXII. *Abscess in the Shaft of the Femur Simulating a New Growth; Opening of Abscess; Cure.*—William B——, a gardener, aged twenty, came up to me from Folkestone, by the advice of Messrs. Eastes of that place, for a swelling occupying the junction of the middle and lower thirds of the left femur, which had been coming on, or at least had been observed, for five months. For two years he had had pain off and on in his left thigh, but he did not think there was any swelling. Two months before being seen he had had an attack of bronchitis, and on his recovery from this the pain in his left thigh became worse, and a swelling was discovered. For two weeks he went about his work, although with pain, which was not, however, very severe during the day, but at night it prevented sleep. For two months he had been unable to get about, and on account of this pain he sought advice. When I saw him on January 6th, 1888, I found an ovoid spindle-shaped enlargement of his left thigh-bone, extending downward to the knee, and some effusion into the knee joint. The swelling was very clearly defined, and on gentle manipulation was not painful; in certain parts, however, firm pressure was resented. The limb measured an inch and a quarter more on the affected than on the sound side. The man went into Guy's Hospital for treatment. Two days after I first saw him a change had taken place in the tumor. It was less defined; the old pain had gone; but the swelling was tender. There was likewise more swelling in the adjacent soft parts, and also there was more heat. On January 13th the swelling was explored through an incision made on the anterior and outer part of the thigh, over the tender spot; and when the bone was reached a small discharging orifice, just large enough

to admit a probe, communicating with the interior of the bone was found. From this orifice pus exuded. The abscess cavity in the bone was then laid open by means of a chisel and strong scalpel, and about two ounces of pus were evacuated. There was no necrosed bone found. The cavity in the bone was smooth. I well washed and syringed out this cavity with hot iodine water; with the same lotion thoroughly irrigated all the soft parts into which pus had escaped, and dressed the wound with iodoform gauze dipped in terebene oil, after having introduced a drainage-tube into the abscess cavity. The limb was then secured upon a back splint. In the subsequent history of the case there was nothing striking to relate, for recovery went on steadily and painlessly, and in two months the wound had healed. Later on the wound reopened, and some dead bone, which had formed the wall of the abscess, was removed.

Trephining a bone the seat of chronic ostitis, or of what is often called *condensing* ostitis, is an operation of recognized value, although it has, as a rule, been undertaken from a mistaken diagnosis, and under the belief that a chronic abscess in the bone existed. The experience thus gained has, however, taught surgeons an important lesson, and that relief to a prolonged, persistent, and disabling pain in a chronically inflamed bone may be expected to follow the operation of trephining. Under such circumstances it may well be a matter of surprise that the principle upon which the operation proved of value has not been more fully recognized, and that the expediency of relieving tension in a bone the seat of a chronic inflammation has not been accepted. For it might have been fairly argued that if in a chronically inflamed bone relief to pain may be expected to follow the operation of trephining, even when the disease has persisted for many years, the same operation, or its equivalent, if applied earlier, would not only bring about equally good results, but at the same time tend to prevent or modify the changes in the bone which are generally met with in such cases, and which the preparations in our museums so abundantly illustrate. That there is truth in this argument it is quite impossible for me to doubt; and I am convinced that if surgeons would, as a principle of practice, apply their art to relieve tension in all bones the seat of inflammation, much suffering would be saved and fewer bones and limbs sacrificed; the cases of inflammation of the bone would be far more amenable to treatment, and a principle of

practice would be introduced which would bring these hitherto difficult cases of disease within the limits of curable affections, without the frightful destructive changes with which we are all too familiar. By way of illustration I append the brief notes of a few cases in which success followed treatment.

CASE XXXIII. *Chronic Ostitis of the Shaft of the Tibia of Sixteen Years' Standing; Trephining; Cure.*—C. H——, aged twenty-nine, came under my care in January, 1885, with an enlargement of the shaft of the right tibia at the junction of the upper and middle thirds of the bone, which had been coming on for sixteen years, or more than half the man's life, and had followed a severe blow. The bone measured transversely at the spot indicated one inch more than its fellow, and vertically the swelling occupied about three inches of bone. To the hand the affected bone felt hotter than the other, but there was no pain on pressure. There had been during the past sixteen years a constant aching pain in the part, and after much exercise a throbbing. The pain was always worse at night. There was no history of syphilis, and the patient generally was fairly well. Having diagnosed chronic ostitis, I trephined the bone in the centre of the swelling, and used a large trephine. I perforated down to the medullary cavity, although with difficulty, as the bone was very dense. I also drilled the bone in two other directions from the trephine opening. The operation gave full, immediate, and permanent relief to all the symptoms, and a good recovery followed. I saw this gentleman a year later, when he was quite well, the bone having much contracted.

CASE XXXIV. *Chronic Ostitis of the Shaft of the Tibia of Four Years' Duration; Trephining; Cure.*—Alice J——, aged sixteen, came under my care in December, 1878, with considerable enlargement of the upper third of the right tibia, thickening of the soft tissues over it, and pain of a severe character in the part. The pain, which was at times aggravated, was said to resemble the "ticking of a clock." Her temperature was 100°. The swelling had been slowly coming on for four years after a fall upon a stone. I cut down upon the part, and, having reflected some thickened periosteum, trephined the bone down to the medullary canal. The bone which was removed by the trephine was dense, like ivory. Everything went on well after the operation, and the original pain at once ceased. The wound granulated up in a month, and when seen six months later the patient was well. She had not had any return of pain, and the thickened bone was fining down. The temperature, which was 100° at the operation, fell to normal, where it remained.

CASE XXXV. *Ostitis of the Shaft of the Tibia; Trephining of the Bone, with Relief to Pain; Subsequent Necrosis;*

Recovery.—James W——, aged twenty, came under my care in June, 1860, with enlargement of the shaft of his right tibia from inflammation following a blow eight months previously. The bone was much expanded, and the seat of a constant, and at times intense pain, which was always worse at night. I trephined the bone, and removed a central circular piece of bloodless, dense, waxy-looking bone and, as a result, all pain permanently ceased. Some limited necrosis, however, took place at a later period, and after the sequestrum was removed recovery followed.

Case XXXVI. *Ostitis of the Lower Half of the Shaft of the Right Humerus; Drilling the Bone; Recovery.*—I was consulted by M. R——, a healthy-looking youth, aged seventeen, in September, 1871, for a considerable enlargement of the lower half of his right humerus, which had been steadily increasing for at least five years. It was the seat of a constant pain, which was always worse at night ; at times he had attacks of very severe pain in the part. He could give no history of injury. When I saw him the bone seemed to be uniformly enlarged and smooth. It was not painful on gentle manipulation, but firm pressure over the bone excited pain, as also did forcible movements of the joint. I looked upon the case as one of chronic ostitis, and drilled the bone at its outer aspect in three or four places. Blood alone escaped. All pain, however, left the part after the operation and the wound healed. Six months later the patient was well, and the bone had much diminished in size.

Case XXXVII. *Chronic Ostitis of the Tibia of at least Ten Years' Duration; Trephining of Ivory-like Bone; discovery of a small Sequestrum in the Bone; Rapid Recovery.* —Mrs. M——, a lady of about thirty-five years of age, consulted me in July, 1880, with a tibia which was clearly much enlarged about its centre, and the seat of a dull aching pain for at least ten years. She was married, and had been much in India. She was apparently in other respects healthy. The pain in the bone was constant; but at times, and particularly at night, it was much worse. The bone where it was affected was about twice its normal size. There was no history of injury. I regarded the case as one of chronic ostitis, and accordingly trephined the bone, Dr. Wyman, of Putney, kindly assisting. I used a trephine about three quarters of an inch across, and never had so much difficulty in removing a cylinder of bone, that which was cut through being like ivory. Having cut well into the bone, I removed the cylinder and found at its base a small spiculum half an inch long, resting in a cavity which just fitted it. This sequestrum I removed. The operation at once gave relief, but the wound was some four months in healing. The pain the patient had endured, however, never returned. This lady is now quite well, and has never had any more trouble with, or pain in, her leg.

My colleagues have likewise followed the practice I am now inculcating. Thus, three cases of acute ostitis have been treated by drilling; and in all pus was evacuated. In one of these two cases recovery at once took place, and in the remaining the necrosis that followed was only superficial. Twelve cases of the drilling of bones for chronic ostitis have likewise taken place in the practice of other colleagues, and in each one relief to pain was at once afforded. In seven of these cases a speedy recovery followed the operation, although the symptoms of local ostitis had existed for years, varying from two up to twenty-six. In six of the cases there had been severe local pain from six to ten years. Four other cases were much relieved by the measure, but it is not known whether they were cured. In the twelfth case the hip disease for which the operation was undertaken was not arrested. The operation of trephining bone was performed on seventeen other occasions, and in thirteen of these speedy recovery was the result of the measure, although in one with subsequent necrosis. In three instances relief was given by the operation, but the joint disease for which it was undertaken, with the view to its arrest, continued, and had to be treated. With these hard facts, based on an analysis of thirty-two cases, it can hardly be said that the operation of drilling or trephining inflamed bone is not successful.

Time tells me that I must now draw to a conclusion; and as I have applied the principle of practice I am advocating to every variety of inflammation of bone, I may be allowed to summarize the whole in the following conclusions:

1. The pain associated with every form of inflammation of the bone or of its periosteal covering is due to tension, and the severity of the pain is a fair measure of its intensity.

2. In acute inflammation of the bone or its periosteum, tension is the chief cause of necrosis; and in the subacute and chronic forms it is a potent cause of their chronicity, as well as of the destructive changes which as a rule follow.

3. The relief of tension, wherever met with, when the result of inflammation, is an important principle of practice which should be always followed. In bone the principle is most imperative, on account of the difficulties under which natural processes act in that direction, by reason of the absence of

elasticity or yielding in bone, and by reason of the anatomical arrangements of its vessels which favor blood stasis.

4. To relieve tension in the softer tissues of the body, the local application of leeches, local or general venesection, acupuncture, aspiration, punctures, and incisions may be requisite; whereas, to carry out the same practice in endostitis or periostitis, subcutaneous or open incisions down to the bone, and the drilling, trephining, or laying open of bone by a saw, may be required, the choice of method having to be determined by the requirements of the individual case.

5. In the early or hyperæmic stage of inflammation of bone, before destructive changes have taken place, experience seems clearly to indicate that the relief of tension—as indicated by a dull aching pain, etc.—by means of drilling or trephining into bone, may arrest the progress of the disease, and help toward a cure by resolûtion; whereas, in the exceptional cases in which this good result does not take place, suffering is saved and destructive changes are limited.

6. In articular ostitis of every kind and variety and in every stage, this mode of treatment cannot be too strongly advocated, as tending toward the prevention of joint disease.

7. In acute or chronic abscess of bone, diaphyseal or epiphyseal, the abscess cavity must be opened, drained, and dressed in the most appropriate way—the principles of treatment being the same in hard or soft tissues, although they are modified by the anatomical conditions of the parts.

With these conclusions, Mr. President and gentlemen, I close my lecture. I fear much that to some I may have proved wearisome; and more, that I have failed to convince others of the value of the practical principle I have brought before you. My wish has been to carry conviction to every mind, and where I may have failed the fault must have been more in the way the subject has been placed before you than in the matter itself. At any rate, gentlemen, I have to thank you for your kind attention, and to express the hope that your own reflections on the subject will fill up my deficiencies, and that in the end all will be convinced that the relief of tension in inflammatory affections generally, if not always, is as a principle of practice worthy of adoption.

LECTURE III.

ON CRANIAL AND INTRACRANIAL INJURIES.

THE subject of tension, to which my two former lectures were devoted, leads in no unnatural way up to the consideration of cranial and intracranial injuries, for most, if not all, surgeons will be ready to admit that in such cases the evil effects of tension are notably manifested, and that operations undertaken with the object of evacuating either effused blood or inflammatory fluids pent up within a closed cavity such as the skull—that is, for the relief of tension—are of especial service. It is not my intention, however, to dwell at any length upon this aspect of the question, for I have thought it well to use my present opportunity to bring before you some general considerations on the subject of cranial injuries, which I have good reason to believe are neither sufficiently recognized nor generally taught, and more particularly since these considerations have no unimportant influence on surgical treatment.

As a preliminary reflection, I would emphasize a point which the surgeon should ever bear in mind in all head injuries—viz., that the effects of a force applied to the skull are much influenced by its thickness, and that in this matter there is in cranial bones great diversity. Under these circumtances, a slight blow on a thin skull may bring about a fracture, and no general cerebral injury, since the vibrations originated by the force of impact are expended locally upon the part struck, and are not carried along the bony basal ridges so as to vibrate in the brain structure and bring about mischief. Whereas, while a severe external force may fail to cause a fracture of a thick skull, it may start such intense vibrations within the cranium as to cause bruising or laceration of the brain, either of its surface or of its substance, at a point remote from the seat of impact, and even at times produce laceration of the venous sinuses or of the middle menin-

geal artery. In the former case the injury on the face of it looks severe; whereas it may be comparatively trivial, since there is no cerebral injury. In the latter instance the injury may appear slight, although in reality it is one which bodes death from cerebral mischief.

To say that injuries of the head should always be estimated *primarily* with reference to the amount of damage the cranial contents have sustained, and *secondarily* with reference to the risk of their becoming involved, is to say what all sound surgeons of experience believe and make the basis of their treatment. And yet students are taught to think that scalp wounds, fractures of the skull, hemorrhage beneath the bone, concussion and compression of the brain, and inflammation of the brain are separate and independent affections, with diagnostic symptoms which can be tabulated. The surgeon, however, who goes to the post-mortem room for information, knows too well that in every case of cranial injury of any importance there are certain brain changes common to most, if not all, which should be fully recognized and taken into account in its diagnosis, prognosis, or treatment; and that, should either a fracture, with or without depressed bone or intracranial hemorrhage, coexist in the same case, such a condition had better be regarded as a complication of the common factor rather than as one which stands alone. For example, a man falls or receives a blow upon the head, and is for a time "stunned" —that is, rendered more or less senseless from paralysis of brain function; he is said to be suffering from "concussion of the brain," whatever that term may mean. Another man, as a result of the same kind of accident, receives in addition to the "stunning" a scalp wound, with a fissure either in the vertex or base of his cranium; and he is described as one who is suffering from a compound fracture of the skull, either of the vertex, base, or of both. A third man comes under observation in the same state of so-called concussion, but with a depressed fracture of bone, complicated or not with a scalp wound, and as a result of this depression there may or may not be other symptoms, or those present may be intensified. Under either circumstance, however, his case is described as one of depressed fracture of the skull, giving rise to compression of the brain. Yet in all these different classes of cases there is one common injury, one common source of danger,

present or remote—viz., the condition of the brain which is associated with the injury, and which has been brought about by the "stunning" force. If the general cerebral injury be trivial, the local complication of a scalp wound, or even of a fissured or depressed fracture, is, although serious, comparatively unimportant; if it be of a grave nature, the local complication must, however great, sink into insignificance.

What, then, it may be asked, is the condition of a brain in a state of so-called concussion? Let us inquire. Concussion of the brain means, in a physiological sense, a sudden and more or less complete arrest of the brain's mental and physical functions, brought about by external violence. The brain in its bony case has been made to vibrate more or less roughly either by some general shake of the whole frame, or by some local violence applied directly or conveyed indirectly to the cranium as a localized or diffused force, the effects of this force upon the brain being of necessity proportional to its concentration and intensity, and in a degree to the age and healthiness of the brain structure and the thickness of the cranial wall. Thus, a concentrated blow with a blunt or edged instrument, probably, and in a thin skull certainly, spends its force in producing a local cranial or cerebral injury; whereas, any force of a diffused nature, directly or indirectly applied, and whether causing a fracture of the cranium or not, more likely brings about some structural change in the cerebral tissue, remote from, rather than at, the seat of impact. And should the brain or its vessels, in either case, have undergone senile or any morbid change, it is more prone to suffer seriously from such external violence than a healthy organ. In every case, therefore, of injury to the head, the brain is made to vibrate more or less forcibly; when the vibrations are feeble, the injury to the brain structure resulting therefrom is but slight; when they are severe, the mischief may be great. The complication of a fissure or fracture of the skull does not of itself, of necessity, tend to aggravate the cerebral mischief; although its presence may be regarded as a measure of the force which has brought it about. In all cases of cranial injury, therefore, the conclusion is clear that the cerebral mischief is the common factor, and the one important point to be taken into account.

This conclusion subsequently leads to the important ques-

tion, What are the changes found in the brain after so-called concussion of its substance, or rather shaking of its structure? What are the structural changes, if any, which can be made out on the post-mortem table? For, of course, an answer to these questions can only be given from the observation of cases which have proved fatal, either directly from the injury, or at some remote period after the injury from other causes. Happily, the answer to this question is neither difficult nor uncertain. For I may say that at Guy's Hospital for at least a quarter of a century there was no case of head injury examined—and such includes every case—in which there was not some coarse brain lesion found, readily visible to the naked eye; in which there was not some contusion of the brain surface, laceration of the brain either upon the surface or within its substance or more or less hemorrhage upon or into the brain. In fact, concussion, in a pathological sense, has been, in my experience, synonymous with contusion or laceration of the brain. Other surgeons have expressed the same opinion from this chair. Sir Prescott Hewett, thirty years ago, said: "In every case in which I have seen death occur shortly after, and in consequence of, an injury to the head, I have invariably found ample evidence of the damage done to the cranial contents." Mr. Hilton, who followed him, wrote: "We ought to consider a brain which has been subjected to concussion as a bruised brain." And Mr. Le Gros Clark, who lectured later, stated: "I have never made or witnessed a post-mortem after speedy death from a blow on the head where there was not palpable physical lesion of the brain." Neudorfer, of the Austrian army, declares that he has never seen concussion, as so-called, since in all cases he has examined cerebral injury was found to exist. And Fano, a celebrated French surgeon, has also come to the conclusion "that the symptoms generally attributed to concussion are due, not to the concussion itself, but to contusion of the brain or to extravasation of blood." In fact, all authorities now agree that, when death follows a severe shaking or concussion of the brain, contusion, bruising, or laceration of the brain is invariably present, and that when this is not found, the death is probably to be ascribed to some other than a cerebral cause; and I shall be able, later on, to show that when death does not take place as an early result of the damage, and the patient either dies of some other affec-

tion or of some remote consequence of the injury, the same evidence of cerebral contusion is generally present. When extravasation of blood upon or into the substance of the brain follows "concussion" or rather vibrating injury, it is to be explained in the same way—that is, by some injury done to the vessels of the brain itself, or to the venous sinuses within its membranes. When due to the bruising of the brain itself, the seat of injury is probably found on the side of the brain opposite to that of the cranium which received the blow; the bruising being brought about by what is rightly termed "contre-coup." A fall or blow upon the occiput is, as a rule, followed by some bruising of the anterior cerebral lobes; one upon the frontal region, by a bruising of the posterior parts of the brain; while lateral or vertical blows are felt more by the middle lobes. In severe vertical blows the base of the brain itself is bruised. The amount of extravasated blood depends upon the degree of force applied and the healthiness of the vessels in the injured part; diseased vessels easily giving way under a vibrating force to which the healthy would not yield. When the extravasation of blood is upon the surface of the brain, it is either within the cavity of the arachnoid or the meshes of the pia mater; and under each condition the blood gravitates to the base. When the extravasation of blood takes place into the structure of the brain, it may be found in any part of the cerebrum, cerebellum, pons Varolii, or even in the ventricles, the extravasation rarely showing itself in the form of one large clot, but commonly in small and numerous spots of extravasation, which cannot be wiped away, as if from small vessels.

Thus I found in one case of so-called concussion, in which the fatal result took place sixty hours after the injury from changes brought about by the severe shaking of the brain, unassociated with fracture, that the brain was bruised all over, and blood was effused at the injured spots; the fluid in the ventricles was blood-stained, and the ventricles themselves ecchymosed.

In another case of death from "concussion," without fracture, the result of a fall, in a man aged thirty-one, on the fifteenth day after the injury, in whom convulsions and coma supervened, a layer of blood was found universally diffused over both hemispheres, dipping between the convolutions, and

passing downward toward the base. The clot, which was shreddy and of a dull reddish-black color, had evidently been effused for some days. The surface of the brain beneath the seat of injury was softened; and at the base, where it had been damaged by contre-coup, similar changes had taken place. The vessels were healthy.

In a third case, where death followed from "concussion," and the vessels were diseased, multiple extravasations were detected after death throughout the substance of the brain.

A fourth case was that of a man (C. K——), aged sixty-five, who came under my care with a scalp wound over the left half of the occipital bone and noisy delirium, having just previously fallen out of a truck on to his head. He had no paralysis or special head symptoms. The pupils were natural; the pulse was 70, and the temperature 99.2°. He became rational in twenty-four hours, but only remained so for a day, when noisy delirium returned, with refusal to take food. This condition lasted for fourteen days, when he sank, although food was regularly and carefully given by the œsophageal tube. After his death on the sixteenth day from the fall, the anterior lobes of the brain, with the fore parts of the middle lobes, were found much bruised and covered with extravasated blood.

And in a fifth case—that of a man aged thirty-five, who came to Guy's on March 31st, and died on April 1st, 1882, about fifteen hours after the accident—blood was found extravasated over the whole surface of the brain beneath the membranes, and the brain itself was much ecchymosed in fine points. The third and fourth ventricles were full of blood-clot. There was laceration of the fornix and right optic thalamus, and no other lesion. The man had fallen on his head when jumping off a van, and given himself a scalp wound, exposing the bone, to the left of the occipital protuberance. He walked into Guy's, and complained only of headache and a feeling of sickness. He refused to stay in the hospital, and left. Having walked 200 yards, he vomited, and his friends gave him a "small soda." He then vomited again, and being unable to stand he was brought back to Guy's, where he was admitted insensible and comatose, and died, as already stated, fifteen hours after his fall.

When fissured fractures of the cranium complicate brain

injuries, and these fractures are the result of some diffused force, the cerebral mischief is not likely to differ from that which has been just described, although, as the force to produce a fracture may presumably be greater than that which fails to do so, the intracranial injuries may be greater from the cerebral vibration. In some cases the brain itself may, in addition, be bruised at the seat of impact. On the other hand, where the force which produced the fracture is concentrated or the brain-case thin, there may be more of local brain injury at the seat of fracture, and less of distant mischief from brain vibration. And with the fracture there may be certain special complications, such as depression of bone with or without compression of the brain, injury to the dura mater, membranes, or brain from the fractured bone or external force, and extravasation of blood between the dura mater and the bone from rupture of the middle meningeal artery or some venous sinus. But all these are complications of, and additions to, the general injury. It must not be forgotten, however, that in exceptional cases a fracture of the skull may take place from a concentrated local violence without producing any cerebral disturbance, particularly over the frontal region.

To prove still more conclusively that "concussion" of the brain means bruising or laceration of the brain, with more or less hemorrhage, I propose to bring before you the particulars of some cases which have been examined at Guy's Hospital after death, at more or less remote periods after the receipt of the head injury; and which died from either an independent affection or some remote results of the injury. Such cases are not numerous, but they are valuable, at any rate, for my present purpose. I trust I shall not, therefore, prove wearisome in reading brief abstracts of some of them.

Case I. *Cerebral Injury; Marked Evidence of Old Bruising of the Brain Found.*—A powerful middle-aged man was found by a policeman in the Borough Market sitting down in a fainting condition. The policeman gave the patient some brandy-and-water, and brought him to Guy's, where he soon became comatose and died. One of his friends said that he had received an injury to his head some weeks (?) previously. After death no external signs of injury could be made out, and there was no fracture of the skull. The anterior and middle lobes of the left hemisphere of the brain were adherent to the base of the skull. The base of the anterior lobe showed

brown discoloration from old bruising, and the middle lobe was so firmly adherent to the bone that it tore away. "These changes," wrote Moxon, who made the examination, "could not have been less than several weeks old, probably at least three months." There was a large effusion of recent blood-clot (two ounces) over the right side of the brain. There was no blood in the brain, and no lesion of its membranes. The viscera were healthy.

Case II. *Cerebral Injury Complicated with Fractured Base of Cranium Thirty-eight Days before Death; Bruising of the Brain.*—David E——, aged nineteen, came under my care on June 24th, 1874, having fallen off an omnibus on to his head. He was admitted into the hospital, partly unconscious, with profuse bleeding from his *left* ear, which lasted for two days, and was followed for another eight days by the escape of a clear fluid (cerebro-spinal). On the second day after the accident the facial nerve became paralyzed. The man died on the thirty-eighth day from broncho-pneumonia, having lost all his brain symptoms except the facial paralysis. On examination of the body, a fracture was found in the skull, across the petrous portion of the left temporal bone, from the turn of the lateral sinus groove behind into the middle fossa, laying open the tympanic cavity. There was no trace of repair in the fracture. The olfactory bulb on the *left* side was gone, and the brain about it was bruised. The central parts of the brain were soft.

Case III. *Cerebral Injury Complicated with Fracture of the Base of the Skull Twelve Weeks before Death; Evidence of Bruised Brain.* (Preparation in Guy's Museum, 1084[55].) —William B——, aged forty-six, came under the care of Dr. Hilton Fagge in 1873, with vomiting after food and pain over the pylorus, which proved to be due to abdominal cancer. He had been an epileptic for four years, and during that time had been growing darker. Five weeks before admission, after a fall on the head from a ladder, he became insensible for a brief period, and blood oozed from his *right* ear, mixed with some watery fluid, which continued to flow for two days. All head symptoms disappeared, although he occasionally lost himself during his illness. He died from abdominal cancer. After death, a fracture of the base of the skull, crossing the petrous portion of the right temporal bone, and running the whole length of the meatus auditorius externus, was found. The under surface of the two anterior lobes and of the points of the left middle lobe of the brain presented a tawny yellow discoloration, clearly the result of blood effusion at the time of the injury, and, as usual, it was more marked on the side opposite to that of the fracture. There was also a little superficial softening of the cineritious substance.

Case IV. *Cerebral Injury Six Weeks before Death, Followed by Abscess.*—William D——, aged thirty, was admitted

into Guy's with pleuro-pneumonia, in a condition which soon ended in death, in March, 1873. Six weeks before his admission a beam had fallen upon his head, hurting him, but not producing any marked head symptoms or any bleeding from the ears or nose. Indeed he had not given up work, but continued as an engineer's laborer for four weeks—that is, up to two weeks before admission, when he felt ill, shivered, and had severe headache; he also soon lost his taste for sweet things. When admitted he had no paralysis, only headache and drowsiness. His temperature was normal. He had no convulsions. After death the brain was found, on removal of the skull-cap, to be flattened, so that it appeared to have no convolutions. Its surface was discolored in parts from what proved to be abscesses. A large and rather old abscess had burst into the hinder part of the right lateral ventricle, filling it with pus.

Case V. *Cerebral Injury Complicated with Fractured Skull and Spine, etc.; Death Ninety-one Days Later.* (Preparation in Guy's Museum, 1084 [52].)—George G——, aged twenty-seven, came into Guy's Hospital, under the care of Mr. Forster, in July, 1882, having fallen or been thrown out of a third-floor window. He was conscious, and complained of pain in his back. He had a scalp wound over the occiput, and evidently a fracture of the occipital bone. His lower limbs were paralyzed from a fractured spine. The patient died of pleurisy. At the necropsy a fissure was found in the right half of the occipital bone, which extended vertically across the root of the petrous portion of the right temporal bone toward the lesser wing of the sphenoid. In the posterior cerebellar fossa there were two offsets, one of which ran down to the foramen magnum. There were but feeble signs of repair in the fracture. The brain at the right anterior lobe was much bruised. There was blood between the bone and the dura mater, and on the inside of the dura mater there was much brown pigment. The eleventh dorsal vertebra was fractured.

Case VI. *Cerebral Injury Six Months before Death, Brought about by Meningeal Apoplexy; Marked Evidence of Old Cerebral Injury.*—Patrick H——, aged forty-one, was admitted into Guy's Hospital, under Dr. Pavy, in March, 1874, in a comatose condition, and soon died. He had been drinking for some days before, and had had a fit. Six months before, or thereabouts, after a fall down some stone steps, he was brought into the accident ward with a bruise over the right mastoid process and discharge of blood from the right ear. He was partially insensible for ten days, and was stupid for some time after. His pulse ranged from 40 to 50. He left convalescent and returned to his work, at which he continued until he had the fit for which he was readmitted just before his death. At the necropsy no injury of the cranial bones could be discovered. The dura mater over both sides of the

brain presented on its inner surface a tawny red color, apparently stained with old extravasated blood. That covering the left hemisphere was smooth, but that over the right was in part lined with adherent coagulum which in some parts was of a brownish color, in others black. Some of it was evidently old. This was part of a large mass of coagulum which lay between the dura mater and the brain, on this side flattening the brain. The surface of the brain was so discolored from staining with blood that the amount of clot was difficult of determination. The brain had evidently been deeply bruised at the time of injury at the inferior surface of both anterior lobes and the summit of the right middle lobe, particularly toward the back of the lateral surface of the right hemisphere, where there was an irregular fissure, with much tawny discoloration of the tissue. The lateral ventricles were healthy. The large effusion of blood clearly came from the rupture of the vessels of the softened part, and was probably in part due to alcoholic stimulants.

Case VII. *Cerebral Injury Thirteen Months before Death; Marked Evidence of Brain Injury.*—George L——, aged twenty-two, was admitted into Guy's Hospital under Dr. Habershon in February, 1871, in a semi-torpid condition, having been found by a policeman in a fit after a day or more of drunkenness. He could be roused with difficulty, and when roused moved all his limbs. He had right facial paralysis. His pulse was 44; the pupils were contracted. He gradually sank. He had had a severe injury of his head thirteen months previously, from which it was supposed he had recovered. After death no signs of injury of the cranial bones were discovered. The brain was flattened, and the anterior and middle lobes were adherent to the dura mater at the base, and the brain tore away when an attempt was made to remove it. The membranes of the brain at the base were very thick, and partly opaque white, partly of an ochre-yellow color; this appearance was confined to the membranes. The aperture into the fourth from the third ventricle was closed by some recent lymph, and the brain bordering the channel was soft. The lateral ventricles were greatly dilated, the descending cornu on the left side projecting like a blister at the base of the brain. The left middle lobe was diffluent.

Case VIII. *Cerebral Injury Two Years before Death from Phthisis; Marked Evidence of Bruised Brain.*—Wm. C——, aged fifty, came into Guy's Hospital with phthisis, under the care of Dr. Moxon, in 1874, and died within a few days. He was a sailor, and had enjoyed good health up to two years previously, when he had a high fall, and was stunned and bled from his left ear. The next day hot fluid came from the ear. He was laid up for three weeks, and when he left his bed he was giddy for nearly one year. He returned to his work, although deaf in his left ear. Five weeks before his admission

he "caught a cold and cough," and died of acute phthisis. At the post-mortem examination no clear indication of fracture of the petrous portion of the left temporal bone could be made out, although there was a slight transverse line across the bone. There was an old bruise of the anterior lobe of the brain on the left side and slightly of the base of the middle lobe. That on the anterior formed an irregular hollow the size of a shilling. The gray substance was quite destroyed, and microscopically was found to present hæmatoidin crystals and compound granular masses.

Case IX. *Cerebral Injury Complicated with Fracture of the Base of the Skull on the Right Side Eight Years before Admission, Followed by Fits, Chronic Hydrocephalus, Spinal Curvature, Emphysema, and Hydrothorax; Marked Evidence of Old Bruising of the Brain.* (Preparation in Guy's Hospital Museum, 1084[56].)—David W——, aged thirty, was healthy until eight years before admission, when he fell off a ladder and hurt his head. Since then he had not been able to do hard work, and his memory had failed him. Five years ago he had a fit, and others had followed. He was admitted under Dr. Wilks in 1876, in a fit, comatose, and passing urine under him; but he gradually recovered sensibility in a few days. In the hospital he had a fit, and both sides of his body were convulsed; when consciousness returned, it was found that the *left* side of his body had diminished sensation, but he said this had existed for eight years, and was gradually growing worse. He was fairly intelligent, and answered questions readily. His pulse was slow, 38 to 40. He died of bronchitis. At the necropsy the brain was found to be flaccid. At the base of the right middle fossa, and over the roof of the orbit, there was a layer of brown pigment; also in the posterior fossa. The same pigment existed in patches over the base of the brain. There were fourteen ounces of fluid in the ventricles. The brain substance was healthy. The foramen magnum was altered in shape, and narrowed antero-posteriorly, the transverse diameter being much larger than the other. There was fracture of the right side of the base of the skull. The spine was curved at the sixth dorsal vertebra toward the right. The cord was healthy. The lungs were emphysematous; fluid existed in the left chest.

Case X. *Cerebral Injury Complicated with Fracture of the Skull Nine Years before Death; Evidence of Old as well as of Recent Brain Injury.*—Michael L——, aged fifty, came under Mr. Cock's care on December 29th, 1867, and died on January 7th, 1868. He had fallen twenty feet on to the side of his head, and was admitted with a scalp wound and depressed fracture of the left of the vertex. He was unconscious on admission, but not paralyzed, and was never clear enough to give a history of his accident. One of his friends stated that he had had an injury to his head nine years previously.

After death the cranial bones were found to be thin. On the occipital base, about the left part of the groove for the torcular Herophili, were *fine* rough elevations, and here the dura mater was very adherent. About this part there was an old depressed irregular fracture of the bone, the bone being now united to the rest. Within the skull there was an elevation corresponding to the external depression, and its edges were bevelled off. There was no sign of any old external wound over the fracture, or of blood between the bone and dura mater; but on opening the latter about an ounce of liquid clotted blood was found effused over the left vertex, corresponding to the recent scalp wound. The right anterior lobe of the brain was adherent over the orbit, and the brain here was discolored brownish-yellow, as from old hæmatoma, this part corresponding to the spot of contrecoup from a blow on the left back of the head.

Case XI. *Cerebral Injury Complicated with Fracture; Evidence of Brain Bruising, Recent and Old.*—Michael W——, aged fifty-three, came into Guy's Hospital, under Mr. Cock, in February, 1867, and died in two days. He was found in the street insensible, with a wound on the back of his head and bleeding from both ears, but chiefly the left. He died comatose. At the necropsy there was clear evidence of a heavy blow having been given over the right mastoid process, the bone at this part being fractured. There was no blood between the bone and dura mater at this part, but there were about two ounces between the dura mater and the brain. There were *recent* contusions on the anterior and middle cerebral lobes, and *old* yellow discoloration of both middle lobes. The right one was firmly adherent to the middle fossa outside the foramen ovale. Lining the dura mater of the right middle fossa of the base of the skull there was a thin membrane, easily separable; and this was thickest where the brain was adherent. The right middle lobe was more deeply bruised than other parts, where it was fixed to the fossa.

Case XII. *Compound Fracture of the Cranium, with Marked Brain Symptoms, Occurring Three Years and a Quarter Previously; Necrosis of the Inner Table of the Skull; Removal of the Bone by Trephining; Death from Phthisis; Evidence of Bruised Brain and Extravasation of Blood.*—Conrad H——, aged forty-five, came under my care in January, 1879, with a discharging sinus on the right side of the occipital protuberance, communicating with the interior of the cranium, which had been the result of a compound fracture of the skull he had sustained three and a quarter years previously. The injury was brought about by a blow from a large stone, which stunned him, and he remained unconscious for seventeen days. He was abroad at the time, and had no treatment. About one year afterward some pieces of necrosed bone were taken from a second fracture on the vertex of the

skull he had received at the same time. He had then some slight weakness of his left side. For the last year the sinus had discharged freely, and he had had much headache. Finding on examination that some necrosed bone could be felt within the cranium in the direction of the internal occipital protuberance, I trephined the bone with an inch trephine, and enlarged the opening with Hoffmann's forceps. Having done this, I removed numerous fragments of the inner table of the skull, corresponding with the lateral and longitudinal sinuses. The dura mater within was thickened, and covered with granulations. The operation gave much relief to his head symptoms, but his lung trouble slowly extended, and destroyed life five months subsequently. After death the repair of the base of the skull was found to be complete, but the bone was thick and irregular. The opening in the cerebellar fossa was only partially closed. The dura mater corresponding thereto was thick. The torcular Herophili and sinuses were healthy. The dura mater covering both cerebral hemispheres was tawny with old extravasated blood; indeed, a thin membranous film could be stripped off its inner surface. The summits of the middle lobes of the brain at its base showed some tawny erosion, evidently the result of former bruising. The lungs were extensively diseased.

The evidence I have thus laid before you of the pathological conditions of the brains of those who have suffered from what has been so long known as "concussion of the brain" will, I trust, be [illegible] such as may be [illegible] that [illegible] cerebral injury; that term [illegible] with more or less [illegible] of the brain [illegible] and varying in [illegible] very slight and [illegible]

[illegible]—that the details [illegible] demonstrate [illegible] the brain [illegible]

permanent? It is to be regretted that an answer to these questions can only be given in an unfavorable form; and that, while we may be hopeful as to this complete repair and recovery from a slight injury or bruise, we are bound to regard graver cases in a more serious light, and to deal with them accordingly, since what evidence we possess seems to show that when any portion of the brain has been severely or moderately bruised, it has been permanently injured. This evidence also dovetails in with the general experience, which tells us not only of the presence of physical head symptoms, but that the mental and moral characters of men are often permanently altered by a head injury.

With these facts and conclusions before us, am I, therefore, wrong in assuming with some confidence that you will see with me the expediency of combining with the term "concussion" that of "injury," and of describing such cases in the future as those of injury of the brain from concussion? The term "concussion" by itself is vague and delusive, while that of "injury" is clear and true, and conveys at once a meaning the force of which cannot be misunderstood. The word "concussion" later on may be dropped, and the simple term "injury" retained. With this starting-point, it would naturally follow that fractures of the skull in all their varieties, hemorrhage into the cranium in all its forms, and compression of the brain, however brought about, will be regarded as complications of the one common and essential factor, cerebral injury, and not, as now, be regarded as separate and individual troubles to be dealt with independently. And even scalp wounds, the result of external violence, would assume a position in the surgeon's mind they ought to have, but have not yet attained; and consequently receive the attention to which they are entitled, not so much perhaps on their own individual account as simple wounds, but as wounds mostly brought about by direct violence applied to the cranium, and consequently liable to be complicated with some contusion of the cranial bone or intracranial injury.

Up to this time my observations have been confined to the elucidation of the first of the two main clinical points which have had a common bearing upon all cranial injuries, and to which I drew your attention at an early period of this lecture —namely, "that all injuries of the head should be estimated

primarily with reference to the amount of damage the cranial contents have sustained;" and I trust I have demonstrated with sufficient clearness that a cerebral injury of some kind is the one common factor. I propose now, therefore, to pass on and consider the treatment of cranial and intracranial injuries, and, with the light which the above conclusion throws upon the whole subject, see what bearing it ought to have upon the second clinical point to which attention has been drawn—viz., "that injuries of the head should be estimated *secondarily* with reference to the risk of the cranial contents becoming involved;" and it should be remembered that this risk is one to which every degree and variety of cranial injury is liable. In even such an apparently simple accident as a contusion of the head, whether with or without a scalp wound, the fear of this secondary danger ought not to be overlooked; indeed, it ought always to be held in view, for I imagine there are but few surgeons who have not been called upon to treat examples of scalp wounds, or patients who, having had cranial blows and being supposed to have been cured, have, on going to work or moving about, or after some indiscretion of diet, complained of headache, restlessness, giddiness, nausea, or even vomiting, with more or less febrile disturbance—all these symptoms being those of cerebral irritation, or the first step of inflammation. Or possibly the patient has complained only of local pain at the seat of injury, and the surgeon on examination finds some swelling of the soft parts over the bone or some change in the appearance of the wound, its healthy granulating surface having assumed a pale, flabby condition, always suggestive of an early ostitis or periostitis. "Acceleration or hardness of pulse," wrote Percival Pott, "restlessness, anxiety, and any degree of fever, after a smart blow on the head, are always to be suspected and attended to. . . . When there is a wound, it will for a time have the same appearance as a simple wound. But after a few days all these favorable appearances will vanish: the sore will lose its florid complexion and granulated surface, and become pale, glassy, and flabby; instead of good matter, it will discharge only a thin discolored sanies, and the pericranium will separate from the bone. The first appearance of alteration in the wound immediately succeeds the febrile attack, and as the febrile symptoms increase the sore becomes worse and worse.

. . . Through the whole time, from the first attack of fever to the last and fatal period, an attentive observer will remark the gradual alteration of the color of the bone, if it be bare. At first it will be found to be whiter and more dry than the natural one, and as the symptoms increase the bone inclines more and more to a kind of purulent hue or whitish color." These extracts I have taken from the works of Percival Pott, who first drew attention to this danger of bone inflammation as a result of cranial injury a century ago, but possibly made too much of it. He regarded it as the chief element of danger in all cases of contusion, scalp wound, or fracture, and not only trephined the skull when ostitis existed, but laid it down as a rule that "perforation of the skull is absolutely necessary in seven cases out of ten of simple undepressed fracture." The operation for trepanning was called for in these simple cases "to *prevent* the effects of inflammation, detachment, and suppuration of the dura mater, and consequently the collection of matter between it and the skull." From this overestimate of the value and necessity of the operation of trephining in cases of fracture, and the comparative rarity of cases of abscess between the bone and dura mater as a direct result of contusion, surgeons have been prone to treat too lightly the risks of a secondary ostitis following bone injury, whether complicated or not with scalp wound or even with fracture, and consequently to neglect what was good in Pott's teaching. As a result, I feel sure that many lives are lost yearly, and that many narrow escapes from death occur. I have the notes of some fatal cases of the kind before me, which I have taken from the post-mortem records of Guy's Hospital. In four of these pyæmia was the immediate cause of death, and such a result was probably brought about by the inflammation of the venous channels of the diploë of the injured bone. I will not weary you by reading all the details of the cases, but will lay before you their chief points.

Case XIII. *Scalp Wound; Ostitis; Necrosis; Pyæmia.*—T. G——, a man aged twenty-two, having fallen from a height, came into Guy's Hospital with a scalp wound and a compound fracture of his leg; he died from pyæmia. The scalp wound had apparently healed, and the man with his compound fracture seemed doing well in all ways, when on the tenth day headache and febrile disturbance appeared, followed by swelling in the seat of cranial injury, reopening of the

wound, and suppuration of the parts covering the bone, from which the pericranium had loosened. Indications of pyæmia soon appeared, but no general head symptoms, and he died in two weeks. At the necropsy, the anterior half of the parietal bone beneath the scalp wound was of a whitish color, bare for a space of three by two inches, and apparently dead. The necrosis extended through the bone, and on the surface of the dura mater beneath the bone there was lymph with pus, as also on the arachnoid surface. The brain was healthy. There were pyæmic abscesses about the body.

Case XIV. *Scalp Wound; Ostitis and Necrosis of the Injured Bone; Meningitis; Pyœmia.*—Eliza S——, aged forty, came into Guy's Hospital with a large scalp wound over the right parietal region, and exposed bone. The injury was the result of a fall off an omnibus, which for a few minutes stunned her. The next day she complained of headache, and on the fourth day it was incessant. On the ninth day sleeplessness and indications of fever appeared; the wound also became unhealthy. On the twenty-first day there were rigors, and on the twenty-fifth some hemiplegia on the left side, for which the operation of trephining of the right parietal bone was performed, and some fetid pus evacuated from beneath the bone. The dura mater beneath the bone was velvety. Convulsions soon came on, and death in a week. At the necropsy, the whole thickness of the right or injured parietal bone was found to be dead, and the dura mater beneath discolored. The surface of the brain corresponding to the dead bone was covered with pus. Pyæmic abscesses were present in the lungs and liver.

Case XV. *Scalp Wound; Ostitis of the External Table, Fracture of the Inner Table; Pyœmia.*—Edw. N——, aged eighteen, having received a scalp wound to the right of the vertex of his skull from a falling bucket, came to Guy's Hospital without any head symptoms, and had his head dressed. The wound healed rapidly without pain or trouble in about ten days, when some local swelling appeared, followed in two days by fever and rigors. In this condition he was admitted into the hospital, where pain and swelling of the right elbow-joint appeared, and later on chest symptoms, which proved fatal three months after the primary accident. After death, the outer shell of the parietal bone beneath the scalp wound, to the extent of an inch and a half by one inch, was necrosed, but it had not been fractured. The inner surface of the corresponding area of bone was fractured, the fracture lying in the long axis of the oval necrosed piece. The fracture was a mere fissure, slightly starred, and its edges were perceptibly raised. A little stringy lymph hung about the bone. Over the dura mater corresponding to the fractured bone there was a yellowish patch of lymph. The brain was healthy. There were pyæmic abscesses in the lungs, liver, and elbow.

CASE XVI. *Scalp Wound; Exposed and Inflamed Bone; Death from Bronchitis.*—A man, aged twenty-three, having been jerked from the shaft of a cart, received a blow and a wound over his left temple which exposed the bone. There were no head symptoms. The wound was carefully dressed antiseptically, and for a week everything went on well. At the end of that time his temperature went up to 104.6°, and the glands of his neck commenced to enlarge. On the tenth day he had paralysis of the left facial nerve, and bronchitis set in, which quickly destroyed the patient, three weeks after the injury. At the post-mortem examination, two square inches of the left or injured temporal bone were exposed. The bone was dry and discolored, but there was no obvious necrosis. The diploë of the bone in the line of section of the calvaria on the left side was more vascular than that on the right side. The brain and dura mater were healthy. The bronchial tubes were filled with viscid mucus. The other organs were healthy

CASE XVII. *Scalp Wound; Necrosis of Bone; Abscess in the Brain.*—A male child, aged three, six weeks before death fell on his forehead, causing a wound one inch above the left orbit. No head symptoms were induced by the fall, and for three days all seemed to be well, when he fainted in his mother's arms. He was then brought to Guy's Hospital, and requested to be left; but to this the mother objected. A few days later the child again fainted and vomited, and as the vomiting persisted the mother brought her child into the hospital. At that time, sixteen days after the accident, the wound had healed, and the scar was adherent to the bone. The child vomited daily, and his temperature was just above normal. A week later, without any important change in the symptoms, the child had a fit which lasted an hour. During the fit the right leg was rigid, and the arm with the fingers and thumb became spasmodically flexed. The left limbs also moved spasmodically. Temperature, 106°. In two days the child died. After death the frontal bone at the seat of injury was covered with purulent lymph beneath the pericranium. Beneath this the bone was rough and ulcerated. The inner table over a space the size of a sixpence was opaque yellow. When sawn through, a piece of the outer table was loose and necrosed. The dura mater at this spot was adherent to the brain. There was a little pus on its outer surface. The left frontal lobe of the brain beneath this spot was soft, swollen, and fluctuating, and when cut into was found to contain a large abscess of the size of an apricot, which had a distinct lining membrane. There was no red softening.

CASE XVIII. *Scalp Wound; Necrosis of Bone; Abscess of the Brain.*—A middle-aged woman three weeks before her admission into Guy's Hospital received a scalp wound from a blow upon the forehead. She continued at her work for two

weeks, and it is said without any head symptoms, when she became comatose and died in a week. She was brought to the hospital in the dying comatose stage. At the post-mortem examination a sloughing wound was found to occupy the centre of her forehead, and beneath it bone was exposed. The surface of the bone was yellow and dead, but not depressed. The area of dead bone was separated from the living by a shallow groove. The inner surface of the bone was blackish; the diploë was full of pus. There was chocolate-colored pus beneath the dura mater of the injured part, and the brain beneath was suppurating, the abscess burrowing backward.

Case XIX. *Contusion of Cranium; Pott's "Puffy" Tumor; Trephining; Meningitis; Death; Bruised Brain.*—W. L——, aged forty-six, was admitted into Guy's Hospital, under the care of Mr. Howse, on December 13th, 1882, fifteen days after having been knocked down by a cab and stunned. He was taken home after the accident, unconscious, and remained in that state for three hours. He then vomited and brought up blood. The next day he became drowsy; and four days later he had a convulsion, which was followed by others for three days. He then became delirious and unconscious. When admitted he was in a low typhoid state, constantly muttering and picking at the bed-clothes. Temperature, 100.4°. There was no paralysis. A swelling was found over the vertex of the skull. This was cut down upon, and blood was seen effused beneath the pericranium, which readily peeled off the bone. The bone was bruised and yellowish. The inch trephine was used. The dura mater, which bulged into the opening and was covered with lymph, pulsated. Nothing more was done, except that the wound was dressed and cold applied to the head. The delirium, however, continued, and gangrenous pneumonia set in, which proved fatal on January 13th, thirty days after the accident. After death the base of the brain was found to be bruised by contre-coup, and there was diffused meningitis.

The cases I have quoted were all examples of ostitis and necrosis, the result of a contusion of the bone associated with scalp wound. I could give as many more associated with fracture if they were needed, and they would all tell the same tale. In none of the cases were there any symptoms of brain injury after the accident, and in most the symptoms did not appear for a week or ten days or a fortnight afterward. In all, the mischief which produced death had clearly originated in the bone. In none of the cases had much care been employed to guard against the secondary mischief which took place, and which led on to a fatal issue; and it may reasona-

bly be thought that, if judicious treatment had been applied from the receipt of the accident, no such result would have been recorded. The conclusion is therefore clear, that all scalp wounds which lead down to bone should be dealt with, for at least a fortnight or three weeks, with much care; and that such cases should, if possible, be treated as in- and not out-patients of hospitals for that time. For it is not the wound treatment only which calls for care, but the patient should be kept quiet, and given a simple unstimulating diet. Stimulants of all kinds should be forbidden, and meat allowed in very limited quantities. If at the end of two or three weeks, or thereabouts, no local or general symptoms appear to suggest mischief, the duties of life may be gradually recommenced. But even then a caution should always be given to observe care.

When local symptoms appear, such as have been described, a free incision down to the bone where no wound exists, or a free separation of the pericranium where there is a scalp wound, always does good. And should any symptom appear or persist which even suggests any intracranial complication, the operation of trephining should at once be had recourse to. "The spontaneous separation of the pericranium, if attended with general disorder of the patient, with chilliness, horripilation, languor, and some degree of fever, appears to me," says Pott, "from all the observations I have been capable of making, to be so sure and certain an indication of mischief underneath, either present or impending, that I shall never hesitate about perforating the bone in such circumstances. . . . When there is just reason for supposing matter to be found under the skull the operation of perforation cannot be performed too soon; it seldom happens that it is done soon enough. The perforation sets the dura mater free from pressure, and gives vent to collected matter, but nothing more. The inflamed state of the parts under the skull, and all the necessary consequences of such inflammation, call for all our attention fully as much afterward as before; and although the patient must have perished without the use of the trephine, yet the merely having used it will not preserve him without every other care." The prevention of this fatal trouble is, however, the more important point to emphasize; and for that purpose I bring the subject before you. Its early treatment may be beneficial and successful; its later treatment can-

not be said to be so. Let us, therefore, teach the necessity of keeping patients with all but minor scalp wounds, and with those even where the bone is exposed, quiet and unstimulated for some weeks after the receipt of the injury where it can be done, and by so doing give nature an opportunity of repairing the mischief in the bone, which, though unseen, may reasonably be expected to be present after the application of a force sufficient to produce a scalp wound or a more severe injury. When a blow upon the head is known to have produced a fracture, the case is likely to be treated carefully; whereas, when no such fracture can be made out, and there is little or no external evidence of injury, the same care is not likely to be observed, although in both cases the violence which had been employed may have been equal. Yet in both cases the dangers of cranial ostitis from contusion are about the same. The fact, I am sure, requires to be emphasized, that cranial contusions, whether associated or not with fractures or with wounds, are always matters of serious importance, and as such should be treated from the first. Having dwelt upon the dangers of these cases, and illustrated some fatal results, I propose to quote a few examples of their successful treatment.

Case XX. *Scalp Wound, and Subsequent Ostitis, Treated by Trephining; Fissured Bone Discovered; Cure.*—Catherine S——, aged twenty-eight, came into Guy's Hospital in July, 1884, under Mr. Howse, with a scalp wound and fissured fracture of the skull, the result of a blow from a machine. She had no head symptoms, either at the time of the accident or after, and in six weeks she was discharged, supposed to be cured. A month later she was readmitted for continual headache and local pain in the seat of the former injury. She stated that she had not been able to work since she left the hospital. The old wound had reopened a week after leaving. On her readmission bare bone was felt—indeed, a piece of dead bone was taken away. In a day or so the pain in the head had much increased, even to make the patient scream. A crucial incision was then made down to the skull, when a fissured fracture was discovered. This operation did not give relief; consequently, she was trephined over the seat of fracture. The bone was found to be very dense and thickened, and its outer surface rough and pitted. No diploë existed. The dura mater was rough, and shaggy from adherent lymph. All cerebral symptoms had disappeared on the second day after the operation, and a rapid cure took place.

Case XXI. *Contusion of the Head; Ostitis; Trephining; Discovery of Fissured Fracture; Cure.*—Harry D——, aged five, was admitted into Guy's Hospital, under the care of Mr. Howse, on September 29th, 1880, having two weeks previously, in a fall, struck the left side of his head against a curbstone. He was unconscious after the accident for a few minutes, when he vomited. He was kept in bed for two or three days, and was supposed to be convalescent, when he had headache, and at night some lightheadedness. And these symptoms persisted up to his admission to the hospital. At this time, a fortnight after the injury, a fluctuating swelling about an inch in diameter was discovered beneath the seat of injury behind the coronal suture. There was some fever with night delirium, but no paralysis. He was trephined at the seat of swelling, when a fissure in the bone was discovered, and the dura mater was seen covered with lymph. From this time everything went well; headache and delirium disappeared, and convalescence followed.

Case XXII. *Scalp Wound; "Puffy" Swelling; Trephining; Cure.*—William T——, aged four, was admitted into Guy's Hospital, under Mr. Howse, on June 5th, 1885, having a week previously been struck above the right orbit by a swing, and received a scalp wound down to the bone. He progressed well for two or three days, when the wound began to inflame and he became feverish. In this condition he was admitted. The wound at this time was sloughing, and the bone was exposed. Temperature, 101°. A few days later, as no improvement took place, and the child was drowsy, the bone was trephined at a spot near the wound, which had become "puffy." The dura mater, where exposed, was granular, and the bone eroded. All symptoms at once disappeared, and a rapid recovery followed.

I will now pass on to consider the treatment of head injuries in the light of the view I am now advocating, for I am under a strong impression that such a view cannot do otherwise than have an important influence in rendering treatment more simple and intelligible; since, if in every grave, or indeed apparently uncomplicated example, associated with more or less complete paralysis of at least one of the brain functions, such as is indicated by unconsciousness, the surgeon recognizes to the full the force of the fact that the brain as a material organ is bruised or otherwise injured, a line of treatment is likely to be at once suggested which can best favor the restoration of the injured part toward health. Among the means which would probably find favor, physiological and mechanical rest would stand foremost, with the administration of nourishment simple enough to maintain the normal

powers and help repair, and not stimulating enough to excite action. Everything in the form of alcoholic stimulants or solid meats would be forbidden; and this line of treatment would, moreover, be maintained for weeks, and possibly for months, the severity of the injury and the primary symptoms forming the surgeon's best guide to a decision. This careful line of treatment would also be adopted under the wholesome dread of exciting, by sins either of omission or of commission, the one common complication which the surgeon should ever have before him—namely, an inflammatory action in the injured organ. For experience speaks in no feeble terms that this action is readily started and with difficulty quelled, and that it is by such inflammatory changes in the injured brain that most head cases, simple or severe, are brought to a fatal termination. Mr. Hilton recognized this necessity nearly thirty years ago, for he taught "that recognized lesions of the brain and its membranes, associated with blows upon the head (whether the cranium be fractured or not), do not generally, or as a principle of treatment, obtain that extent of mechanical rest which is consistent with the expectation of perfect and complete structural repair. This error in the treatment of such cases is one of the chief sources of the diseases of the brain and its membranes which are met with in practice. . . . In cases of injury of what may be called the coarser structures, with more simple functions attached to them, we see that without perfect restoration of the structures their functions are not efficiently performed, and if used too early and too much they become painful and assume a chronic inflammatory condition. Such soft parts require weeks or months for their repair. Surely, then, we ought not to deny the necessary and proportionately much longer time for the repair of the more delicate brain tissues; a repair, be it remembered, which cannot be accomplished by any direct aid from the surgeon, but only by Nature herself employing her chief agent—Rest." It is a pleasure to me to be able to quote these apt sentences, framed by a former teacher and colleague upon this important subject—although many years have passed since they were uttered—to support the views it has been my privilege to bring before you—views, I may say, that I have for long taught at Guy's, and have reason to believe with some advantage.

Should symptoms of intracranial irritation or inflammation show themselves, they should be dealt with actively, as, from the nature of the brain and its membranous coverings, the process once started soon spreads. In the early stage the application of cold to the head by means of a Leiter's metallic tube is the most efficient local, and free purgation the most effective general, means, with very low diet. If the inflammatory action is great, a free bleeding from the jugular vein or from the arm is strongly to be advocated, and this operation may in many cases be repeated with much advantage. I am convinced I have saved some lives by this treatment. In chronic cases the value of mercury taken internally cannot be doubted.

These, then, are the common lines upon which the treatment of the common factor of all cranial injuries, simple or severe cerebral injury, should always be based; and they should likewise form the lines of treatment of all its complications. Thus, if a simple fracture of the vertex, base, or of both, complicates the case, the treatment is the same. The cerebral injury needs the surgeon's care, and not the fracture, which will take care of itself. A cranial fracture will heal in the same way as other fractures, but it will take a much longer period; and fractures of the base of the skull are apparently among the slowest. In specimens 1084[52] (eighty-four days), 1084[35] (ninety-one days), and 1084[56] (eight years), of the Guy's Museum, and in others of our own College museum, this point is indicated. The fractures of the skull will, at any rate, probably heal sooner than the cerebral injury will be repaired. The treatment for the latter will consequently have to be continued after the fracture has healed. If the fracture be but *slightly depressed*, whether simple or compound, and it appears only as a *fissure*, the case had probably better primarily be left alone, and dealt with secondarily on the smallest indication of cerebral trouble; for in these cases there is rarely comminution of the inner table, and consequently nothing in the form of bony spicules to fret and irritate the dura mater, and thus help forward a meningitis. To trephine in order to elevate this form of fissured fracture would therefore be to add another danger to a case in which the form of cerebral injury common to all already exists. If the fracture be *depressed, starred, or comminuted*, whether

simple or compound, the elevation of the depressed bone should be the rule of practice, and the removal of all the splintered fragments of the inner table carefully carried out, the object of the operation being more to take away what, if left, must irritate the dura mater, and so add to the existing harm, than to relieve the depression. This operation should be performed as much in simple as in compound fractures, for the condition of the bones is the same in both; and with our modern treatment of wounds the danger of the operation in simple fracture is not materially increased. In *punctured fractures* the operation of trephining, undertaken with the object of removing the broken and displaced fragments of bone, should be a rule of practice never to be deviated from. The depressed and comminuted inner plates of bone to a certainty, if left, at a late if not early period of the case, irritate the brain and its coverings, and so set up an encephalitis.

How far the presence or absence of what are called brain symptoms should influence a surgeon in his decision as to surgical interference in the different forms of depressed fractures of the skull we have been considering has been much argued. For the surgeon is quite unable in bad cases of cranial injury to differentiate symptoms, and to say how far those that are present in any individual case are due to the common factor—cerebral injury—which resulted from the force that produced the fracture, or how far they are caused by the depressed and fractured bone. But I am not sure that this is a point of much practical importance, for in a bad case of fracture of the skull cerebral injury is probably already severe, and the operation of elevating depressed bone and of removing comminuted fragments is not likely to aggravate the trouble; whereas in a less severe example in which the cerebral injury is likely to be less serious, the existence of depressed bone and of comminuted fragments must act injuriously, and should consequently be removed. Under all circumstances, it is consequently the surgeon's duty to remove whatever sources of trouble the presence of a depressed fracture may bring to an already serious case of cerebral injury.

The operation of trephining or of elevation of bone in depressed fracture is called for more with the object of removing from the brain what may or will be sources of local irritation rather than with any view of removing the effects of the de-

pressed bone; for it is well recognized that, *per se*, a large area, and a considerable amount, of depressed bone are required to bring about symptoms of compression in an otherwise uninjured brain. Again, it is well known that a considerable extravasation of blood upon the surface of the brain, probably five or six ounces, whether between the bone and dura mater or in the cavity of the arachnoid, is required to bring about marked evidence of its presence, in the form of paralysis from compression. The rupture of the middle meningeal artery is a special complication of cranial injuries, or of fracture of the skull, but I do not propose to discuss it here at any length. I cannot, however, pass it by without referring to the exceedingly able article upon the subject published in the "Guy's Hospital Reports" for 1886, vol. xliii., p. 147, by my friend and colleague, Mr. H. A. Jacobson, since it contains not only a masterly account of every case on record up to date, but also a summary of the whole subject, which claims the close attention of every surgeon. His summary is as follows:

1. That the violence which causes middle meningeal hemorrhage is often slight, and that in these cases no fracture may be present.

2. That where there is a fracture, it is often a mere fissure, and may involve the internal table only.

3. That the history of the case, and, above, all, an interval of lucidity or consciousness, are invaluable, the latter being worth all the other symptoms put together.

4. That the symptoms of compression are in some cases deferred; that their onset may be then very sudden and rapidly fatal, failure of breathing being a marked feature.

5. That in those cases where the history is deficient, especially as to any interval of lucidity, and where it is difficult to be certain about the existence of hemiplegia, dilatation of the pupil on one side, that side corresponding to the clot, is a sign of great value. The explanation of this sign, that the third nerve is being pressed upon by a clot large enough to reach into the middle fossa, we owe to Mr. Hutchinson, with whose name in future this condition of the pupil should be associated.

6. That after trephining, exposure and partial removal of the clot, very severe hemorrhage may set in and prove difficult to arrest.

7. That in severer cases laceration or contusion of the brain are only too frequently complications.

This latter conclusion consequently links this special class of cases with the more general number of cranial injuries, and enables the surgeon to look upon them as a whole in the light in which I have now placed them before you.

There are many other questions in the surgery of cranial injuries which require elucidation, but time will not allow me to bring them under your notice. The points and questions I have selected are such as I believe to be most important to enable the younger surgeons and practitioners to read rightly the manifold and somewhat puzzling phenomena which severe cranial or cerebral injuries exhibit, and I have some confidence in the belief that, if the views I have expounded were accepted, the teaching and understanding of cranial or cerebral injuries would be greatly simplified. In conclusion, I must ask you who have listened to me so patiently and kindly to think over the questions I have ventilated, and to accept from me my warmest acknowledgments of the honor you have conferred upon me by allowing me, as your Hunterian Professor of Surgery, to deliver these lectures from this chair.

ANTISEPSIS

AND

ITS RELATION TO BACTERIOLOGY.

BY

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ANTISEPSIS

AND ITS RELATION TO BACTERIOLOGY.

"NOTHING is lasting except Change, nothing is permanent except Mutation, nothing is settled except the Past,"—in these words does a gifted writer characterize politics; the same antitheses, in my belief, are applicable to medicine and to surgery, for in these sciences the beliefs of individuals are constantly changing, as well as the opinions of physicians in general, in regard to the most important questions. This change in belief occasionally occurs without attracting the special attention of some men, and they think that they stand on the same foundation, without noting the fact of its alteration, sometimes to the advantage and again sometimes to the disadvantage of truth.

Even as travellers on the deep, wide ocean take no account of the quiet, steady motion of the vessel, and notice it only when they reach their haven, and even as, further, they know not the direction of the port they have left nor of that to which they are tending—this knowledge being possessed by the officers and steersman alone from consultation of the charts and compass—even so does the practitioner make his way along the broad ocean of his daily life and occupation. Owing to his anxious and difficult daily task his attention may not be directed to the slow, but continuous progress in his science; he may not note the ever-changing phases of this progress; he only sees the change of scene after it has shifted, when he is conscious of the alteration of theory, method and practice of another. On this new basis he may stand for a decennium,

until progress has again effected an alteration in the beliefs of medical science. He, however, who lives only in the past and looks not to the future, cannot have a complete understanding of that past. His thoughts and hands work empirically and by routine, and this is incompatible with quick alteration, and in so far progress is checked. It is advisable then to stop occasionally in order to consider the course of events in the past and the probability for the future. Thus we can see the generic relationship of the different stages of our art, and take account of the errors of the way which has been traversed.

Owing to the great and with difficulty circumscribed extent of the medical sciences, this backward and forward glance can only be taken in regard to established and limited questions, and I invite your attention to an *exposé* of the present state and future aspect of the antiseptic question.

Inflammation and Fever the Cardinal Symptoms of most Diseases since the Year 1800.

Even in olden times observers noted that the majority of internal and external diseases presented a constant chain of symptoms, such as swelling, redness, heat and pain in the affected parts, tissues or organs. In addition to these characteristic symptoms, there appeared at times an increase of the pulse rate and a general sense of ill-being of the patient.

These observations constituted then as now the characteristics of inflammation and fever. That tissue was said to be inflamed which was red, swollen, hot, painful; while in a patient in whom there existed an increase of the pulse rate, an elevation of the body and blood heat, and a change in the excreta and in the secreta, there was said to be fever.

Very often the causal connection between the inflammation and the fever could not be determined; often, again, the inflammation was not accompanied by fever, even as in many febrile states it was not possible to detect the inflammatory cause. As for the cause of the inflammation and the fever there existed no clear knowledge; only with the introduction of the microscope into medical research has it been possible to study experimentally the intimate sources of fever and of inflammation.

When the finger-web or the tongue, or, better still, the

mesentery of the frog (Cohnheim) is spread under the microscope, we see first a dilatation of the capillary net-work and a slowing of the blood stream. The white blood corpuscles move slowly along the vessel wall, while the red corpuscles remain in the centre of the vessel. The white corpuscles cling to the intima of the vessel, pass through the wall and then extravasate into the cellular tissue. Soon after their movements cease, there occurs a momentary retrogression and then a stoppage of the circulation in the dilated capillary. Shortly after, the white corpuscles lose their pale-gray and homogeneous appearance and break up into sharply demarcated granules. As the inflammation increases there occurs a cloudiness due to the accumulation of white corpuscles which have passed through the vessel wall, and this renders further study by the microscope impossible. We can then only watch certain phases of the inflammatory process and we must judge hypothetically of the relation between the different phases.

As the inflammation progresses we find the white corpuscles in such great number that we cannot believe that they have come exclusively by migration. We believe, therefore, that a part have appeared from division of the leucocytes which have migrated from the vessel, and a part from proliferation of the pre-existing cellular tissue cells. This phase of the inflammatory process is known under the name of suppuration. We no longer call the bodies in the fluid leucocytes, although they resemble these perfectly, but pus corpuscles.

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Mechanical, Thermic and Chemical Irritation as Causes of Disease.

The next question is in regard to the causes of the above changes in the inflammatory area and in the organism, for in the material world change without cause is not to be thought of.

From the earliest times it was assumed that an irritation was at the bottom of the changes to be observed in inflammation. Mechanical, thermic, and chemical irritations were said to affect the tissues and the organs, altering the customary processes in them and causing an inflammation. When the irritant affected the entire organism or spread throughout it then there occurred fever. It was claimed, then, that mechanical injuries, burns or refrigeration (thermic irritation), cauterization with strong acid, alkalies, or mineral substances (chemical irritation), might cause inflammation and suppuration, and, often enough, fever.

In the present century it was supposed that, in addition to mechanical, thermic and chemical irritants, there were others to which I will apply the term organic, and that these also might cause inflammation, suppuration and fever. Otto Weber and Theodore Billroth are to be named as early observers in this direction. They came to the conclusion from their experiments that the above phenomena would result from the entrance into the animal experimented upon of very small amounts of organic substances. They claimed that in blood, in pus, in tissue, by disintegration and chemical process, organic substances were formed which, when introduced into the blood in small amount, would cause inflammation and fever. These newly-formed organic substances, which they did not exactly isolate, they called phlogogenous and pyrogenous ferments.

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flammation of the intestines of animals which had been poisoned by decomposed material, was due to a chemical substance which could not be destroyed by heat.

Later still, Bergmann and Schmiedeberg isolated from fecal matter a crystalline substance to which they gave the name of sepsin, and they determined that, when this was introduced into the bodies of animals, it caused exactly analogous symptoms to those which we find in septicæmia; still the observations of Panum, as well as those of Bergmann and Schmiedeberg remained without influence on medical and surgical practice.

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Pasteur, however, was not the original and only observer who taught the presence of a contagium animatum. We may trace this view back to the year 1700. Then the question was discussed under the term spontaneous generation, although this assumption is not related to contagium animatum, for, if we grant that a coccus or bacterium may develop of itself and need not be brought from outside into the body of an animal, then does the groundwork of bacteriology fall to the ground like a house built of cards.

Without detailing the views of Reddi or entering into the dispute between Buffon and Spallanzani, we will mention here only the following points:

Caignard de la Tour, 1836, determined that the torulla cerevisiæ was a microscopic vegetable cell which, through increase in its cells, broke up sugar into alcohol and carbonic acid, and that the fermentation ended in a sugar-containing fluid. With the death of the yeast cell, or when this through any cause could increase no longer, the fermentation and breaking up of the sugar stopped at once.

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until progress has again effected an alteration in the beliefs of medical science. He, however, who lives only in the past and looks not to the future, cannot have a complete understanding of that past. His thoughts and hands work empirically and by routine, and this is incompatible with quick alteration, and in so far progress is checked. It is advisable then to stop occasionally in order to consider the course of events in the past and the probability for the future. Thus we can see the generic relationship of the different stages of our art, and take account of the errors of the way which has been traversed.

Owing to the great and with difficulty circumscribed extent of the medical sciences, this backward and forward glance can only be taken in regard to established and limited questions, and I invite your attention to an *exposé* of the present state and future aspect of the antiseptic question.

Inflammation and Fever the Cardinal Symptoms of most Diseases since the Year 1800.

Even in olden times observers noted that the majority of internal and external diseases presented a constant chain of symptoms, such as swelling, redness, heat and pain in the affected parts, tissues or organs. In addition to these characteristic symptoms, there appeared at times an increase of the pulse rate and a general sense of ill-being of the patient.

These observations constituted then as now the characteristics of inflammation and fever. That tissue was said to be inflamed which was red, swollen, hot, painful; while in a patient in whom there existed an increase of the pulse rate, an elevation of the body and blood heat, and a change in the excreta and in the secreta, there was said to be fever.

Very often the causal connection between the inflammation and the fever could not be determined; often, again, the inflammation was not accompanied by fever, even as in many febrile states it was not possible to detect the inflammatory cause. As for the cause of the inflammation and the fever there existed no clear knowledge; only with the introduction of the microscope into medical research has it been possible to study experimentally the intimate sources of fever and of inflammation.

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mesentery of the frog (Cohnheim) is spread under the microscope, we see first a dilatation of the capillary net-work and a slowing of the blood stream. The white blood corpuscles move slowly along the vessel wall, while the red corpuscles remain in the centre of the vessel. The white corpuscles cling to the intima of the vessel, pass through the wall and then extravasate into the cellular tissue. Soon after their movements cease, there occurs a momentary retrogression and then a stoppage of the circulation in the dilated capillary. Shortly after, the white corpuscles lose their pale-gray and homogeneous appearance and break up into sharply demarcated granules. As the inflammation increases there occurs a cloudiness due to the accumulation of white corpuscles which have passed through the vessel wall, and this renders further study by the microscope impossible. We can then only watch certain phases of the inflammatory process and we must judge hypothetically of the relation between the different phases.

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The Staphylococcus Pyogenes Aureus, Albus and Citreus, and the Streptococcus as the Causal Factors of Suppuration and of Wound Diseases.

Towards the diagnosis of the different kinds of pathogenetic microbes and their relation to various surgical diseases much is as yet lacking, and there is considerable difference of opinion.

From the observations of Ogston, Rosenbach, Carré and others, it is known that every kind of pus contains a micro-organism, which Ogston, owing to its racemose shape, has called the staphylococcus. This coccus has the peculiarity, when cultivated on gelatin plates, of developing a beautiful orange-yellow pigment, and when man is inoculated with it it causes suppuration. He gave the name of staphylococcus pyogenes aureus to this coccus on account of the above peculiarity. This coccus is widely disseminated through the atmosphere and singularly resistant to reagents; it may be dried, baked, treated to chemical reagents, and yet be neither killed nor deprived of its properties. It is hence conceivable why, after wounds, inflammation and suppuration so frequently set in, and why the staphylococcus pyogenes aureus is found as the causal factor of the pus. This micro-organism, however, is not the only one found in pus. Rosenbach has discovered, as well, a staphylococcus pyogenes albus and Passet a staphylococcus pyogenes citreus.

As to whether these three cocci, which are differentiated the one from the other only by the fact that they develop pigments, are the same or different species we cannot with certainty state; the white and the citron-yellow are, however, much less frequently found than the golden. Even the golden works in different ways: It only causes pus when inoculated in man; animals cannot be inoculated. In animals the staphylococcus pyogenes aureus must be placed under the skin or in a serous cavity in order to cause pus. In case it is directly injected into the blood, it causes the characteristic, dangerous form of endocarditis ulcerosa; when, however, the staphylococcus aureus is injected into the blood of an animal which has broken or injured its leg then it causes an osteomyelitis. If this micro-parasite, furthermore, is injected into the lymph channels, then it causes metastatic abscesses in the liver, kid-

neys, etc., as also suppuration in the joints. Likely enough these metastases in various organs and in the joints, the osteomyelitis and the ulcerative endocarditis, would be caused in man by the staphylococcus pyogenes aureus even as they are in animals upon which we experiment.

In addition to the staphylococcus pyogenes there is another micro-parasite which causes suppuration, although it is rarely met with. It is a coccus made up of small rings linked together in a chain. It is called streptococcus pyogenes, and is readily differentiated from the staphylococcus pyogenes. This coccus, or one so like it that differentiation is not possible, has been found by Fehleisen in the borders of an erysipelatous patch. Fehleisen has cultivated this coccus, and was able with any generation to cause a typical erysipelas.

The Question of Antisepsis.

It is quite evident that there exist a number of micro-parasites which are in a position to cause inflammation and suppuration. We witness daily the fact that one and the same effect may be the outcome of different causes. It is less evident why the same coccus should now cause simple suppuration, and next pus metastases or osteomyelitis, or ulcerative endocarditis, or again typical erysipelas.

Since now we have shown that inflammation, suppuration and different wound diseases are caused by micro-organisms, it follows as a consequence that the therapeutic aim must be to kill these microbes. This essential, however, is a difficult one to satisfy. When the microbes have once entered the body and have there taken their abode, then we have no certain means of dislodging or of killing them without at the same time injuring this body. In the body we can only prevent or limit their development and weaken their injurious action; it is, however, always possible for the weakened coccus to unexpectedly recover its vitality.

Our treatment then must aim at not allowing the microbes to enter the body. Since, however, the microbes exist everywhere—in the air, on our hands, clothing, instruments, bandages, etc., therefore is it necessary to operate, to dress, and to change the dressings of the wounds under careful antiseptic precautions.

Antiseptic Operations.

To-day antisepsis is practiced as follows: The operating room has smooth, polished walls and a so-called asphalt floor. The walls and floor can and must be washed and cleansed before each operation. The surgeon, his assistants and the nurses must wash and brush their hands with soap and water and disinfect them in a 2 per cent. carbolic solution or in a ½ per cent. sublimate solution; their usual clothes should be removed, and clean operating coats should be put on. The instruments required for operation should be jointless (with nickel-plated or hard rubber handles) and should be soaked for half an hour before the operation in a porcelain basin filled with a 5 per cent. carbolic solution. The patient should be washed at the operation-site with soap and brush and then disinfected with sublimate or carbolic. If the site is hairy it should be shaved. When the operation-site is covered with dried pus or scabs these should be loosened with turpentine or benzine and removed. To remove blood small wads of sterilized cotton or gauze, or sponges which have been soaked in 5 per cent. carbolic, should be used.

As yet Schede's method of leaving alone whatever small vessels are cut during the operation and of not washing away the blood which has oozed has not gained acceptance. On the contrary, it is customary to ligate or to twist every bleeding vessel, and to wash away the blood which otherwise it is feared would degenerate. Still, since the blood left in the wound is far less likely to decompose than the blood serum, the issue of which from the tissues cannot be prevented, some surgeons, notably J. Wolf of Berlin and myself, are in the habit of only ligating the larger vessels which happen to be cut. I use in my operations the peroxide of hydrogen, with the double aim of causing contraction of the lumen of the cut vessels and of preventing decomposition of the blood and serum. Schede's method, however, although not generally accepted, has had a good influence over the too careful ligating methods of certain surgical schools.

After the completion of the operation the wound should be washed for from one to two minutes with a 2 to 3 per cent. carbolic solution. This latter manipulation aims at killing or rendering inert any microbes in the wound.

The above directions are followed by all surgeons who operate antiseptically.

Synopsis of the Chief Antiseptics used before and since the Antiseptic Era, and their Value.

I desire, before pursuing this study further, to consider here the chief and most useful antiseptics, from the earliest times to date, in connection with their chemical composition, structure (as far as I am familiar with this), their peculiarities and their dosage.

I will consider as obsolete the great majority of antiseptic dressings, the antiseptic plasters and salves and balsams of the older surgeons, and refer only to the following:

1. *Aqua picis*, or tar water, which is prepared by dissolving one part of tar in five to six parts of water. In twelve to fifteen hours the solution is complete, as far as this is possible. 2. The *aqua vulneraria spirituosa* was obtained by the distillation of alcoholic fluid from different plants. 3. The wine and camphor-containing dressings. 4. The juice of oleaginous, aromatic and tonic plants. 5. The *aquæ plumbica, saturnina, vegeto-mineris, Goulardi*, etc.

In 1854 Burrow proposed as an active antiseptic what is known in the German pharmacopeia as the liquor alumini acetici. The formula is $Al_2 (CH_0\ COO)_4 (OH)_2$. This combination is a difficult one and not stable. Latterly Athenstädt has proposed the following formula, which is readily soluble in water, and not poisonous:

Alumin-acetico-tartarici, .	gr. xxx.–xlv.
Aquæ distillat., ...	℥ iij. ℥ j.

In 1806 Freiherrn v. Reichenbach recommended creasote for dressings. This is a complicated body, the chemical combination of which is not exactly known to me, although I have used it for a number of years.

A few years later carbolic acid was proposed, and Lister has greatly popularized its use.

Pure carbolic acid is not an aromatic acid but rather an alcohol. Its chemical name is phenol, or phenyl-alcohol, and its formula is $C_6H_5 (OH)$. The uses of carbolic are so well known that it is unnecessary to dwell on them here.

The use of phenol led to that of many other antiseptics which are more powerful in less concentration. We will only briefly refer to the following:

Salicylic acid, the chemical formula of which is C_6H_4 (HO) (COOH), is soluble in 300 parts of water and is a very powerful antiseptic.

Next comes sozol-acid, also called aseptol. Its formula is:

$$C_6H_4 \begin{cases} OH \\ SO_3H. \end{cases}$$

It is prepared by mixing equal parts of phenol and concentrated sulphuric acid. After two to three days' rest and neutralization by the carbonate of barium, a 33⅓ per cent. solution of aseptol is obtained, which is soluble in any proportion in water and is neither poisonous nor irritating to the body even when concentrated. I have used aseptol in 5 per cent. solution, but cannot say that it possesses any advantages over phenol or salicylic acid; its sole advantage, possibly, is its usefulness as an antiseptic in eye diseases, where both carbolic and salicylic acids are not readily applicable.

Analogous in its action to aseptol is resorcin (metadioxybenzol) proposed by Hlassiwetz and Barth.

$$C_6H_4 \begin{cases} OH\ 1 \\ OH\ 3. \end{cases}$$

A 1 to 2 per cent. solution is not poisonous as an eye-wash, for inhalations and dressings.

Hydrochinon (paradioxybenzol) has the formula

$$C_6H_4 \begin{cases} OH\ 1 \\ OH\ 4, \end{cases}$$

and has not been used as a surgical antiseptic notwithstanding its anti-fermentative properties.

If equal parts of pure anilin ($C_6H_5NH_2$) and glacial acetic acid be boiled for two days we obtain a fatty-feeling body in the shape of colorless crystalline plates. This is acetanilid,

$$(C_6H_4NH\ (CH_0\ CO),$$

which Kussmaul has given in typhus, intermittent, pneumonia in four grain doses as an antipyretic—whence its name antifebrin.

This is soluble in about 200 parts water, and I have used it in this concentration as well as in powder form as an antiseptic.

I was unable to determine any advantage it possessed over the previously mentioned antiseptics.

On the other hand I have found antipyrin, proposed by Ludwig Knorr in 1884, superior. All antiseptics, in addition to their bactericide properties, possess the power of preventing decomposition and fermentation and of quieting pain, as well as in a measure lowering fever. Antipyrin, while equal to other antiseptics in its property of preventing decomposition and fermentation, as a local anodyne is not approached by any others, and as an external antipyretic it is as powerful as salicylic acid.

The chemical name of antipyrin is dimethyloxylchinicin, and its formula $C_{11}H_{12}N_2O$.

Antipyrin is soluble in equal parts of water, alcohol, or chloroform, and with difficulty in ether. It is most valuable as a local anodyne, as an antiseptic, as a local antipyretic, as also for incorporation in dressings. Its high cost, however, prevents its routine use.

Skraup has synthetically constructed out of anilin, nitrobenzol, glycerin, and sulphuric acid what he has termed chinolin (C_9H_7N). This body is readily soluble in alcohol, ether, chloroform and benzine, but with difficulty in water; according to Donat it is a very useful antiseptic in watery solution. In a 2 per cent. solution it controls decomposition of urine and of fæces; in 4 per cent. solution it prevents blood decomposition; in 1 per cent. solution it prevents the coagulation of blood and of albumin.

It has been used as a local applicant in diphtheria, and as a mouth and tooth wash in the following solutions:

℞ Chinolini pur., ... gr. xxxvij.
Spts, vini gall.,
Aq. distillat., . . . ãã ℥ j. ℥ vj.
S. For local use.

℞ Chinolini, ... gr. x.–xv.
Spts. vini gall., ... ℥ j. ℥ vj.
Aq. distillat., ... Oj.
Ol. menth. pip., ... gtt. 2 to 3.
S. To be used as a gargle.

The following salts of chinolin, owing to their greater solubility in water, are useful in surgery: chinolin-salicylat, chino-

lin-salicylic acid (C_9H_7N, $C_7H_6O_3$), chinolin-tartrate, and the vinegar of chinolin, 3 (C_9H_7N), 4 ($C_4H_6O_6$).

I have only used, as an injection in gonorrhœa, the following formula:

℞ Chinolin tartarici, ... gr. xv.
Aq. distillat., ... ℥iv. 3vj.
S. To be used as an injection.

and I have found it more effective than the usual zinc, silver and permanganate of potass solutions.

Finally, we must refer to sublimate, the best of all antiseptics.

I would here notice the complaint that sublimate, which in solution of 1 to 50,000 is still antiseptic, sometimes fails the surgeon when in solution of 1 to 1000. It appears that 7 minims of bullock serum added to 7 minims of 1 to 1000 sublimate solution, takes away the antiseptic property, the sublimate being rendered insoluble by the serum. To avoid this Dr. E. Laplace, of New Orleans, has suggested the acidification of the sublimate solution.

To prepare an antiseptic sublimate solution Laplace orders:

Hydrarg. bi-chlor., ... gr. xv.
Acid. tartaric., ... 3j. gr. xv.
Aq. distillat., ... Oij.

To prepare an antiseptic gauze solution he orders:

Hydrarg. bi-chlor., ... 3j. gr. xv.
Acid. tartaric., ... 3v.
Aquæ distillat., ... Oij.

These formulæ are being now used in Bergmann's clinic, and they seem to be the best of all for surgical use. Personally I do not use these formulæ, for the reason that I no longer resort to sublimate but to other antiseptics.

I desire still to briefly refer to antiseptic dressings containing powdered drugs.

I have covered wounds with the powder of a large number of plants and chemical substances, placing a gauze bandage over all. I have thus used the pulv. irid. florentin., the pulv. rad. altheæ, and liquiritiæ, the finely powdered kolophonium

and sanguis draconis, the powdered zinc oxide and pure salicylic acid.

These dry powders gave me much satisfaction; the objection to the salicylic acid was the fact that for five minutes after its application it caused intense burning, and in sensitive patients this lasted even for an hour and longer. To avoid this I have mixed the salicylic powder with 3 to 5 per cent. of an indifferent powder. Thus:

Acid. salicylic.	gr. xv.
Ox. zinci	gr. xlv.
Talci venet., ...	ʒ vj. gr. xvj.

is a combination which has yielded excellent results in case of atonic ulcers, especially those of the lower extremities.

I have also used soluble powders over wounds. Thus, chloral hydrate, different metallic salts with 1 to 3 per cent. of indifferent powders (chalk, magnesium, etc.), have been tested. I have found that all antiseptics can thus be used in powder form; even sublimate may be mixed with chalk in the proportion of 1:1000.

This method of mine of using antiseptics in powder led to the suggestion of many combinations, of which I will mention a few.

Mosetig v. Moorhof has used iodoform as a wound dressing on the strength of the strong recommendation of Moleschott, who gave it internally. He spreads the iodoform powder over the wound even as I had done with the salicylic acid powder. He has found that it checks hemorrhage and pain, controls suppuration and cures local tuberculosis. He later impregnated gauze with a 10 to 50 per cent. solution of iodoform in alcohol and ether. Finally he mixed iodoform with equal parts of collodion to form an iodoform-collodion for the skin around wounds.

Iodoform quickly secured the approbation of surgeons the world over. It has, however, great disadvantages. Thus: The penetrating smell of iodoform cannot be disguised, and this smell is to many unbearable. Some individuals are poisoned by the agent; they lose their appetite, become morose, absent-minded, and if the action be continued there result psychical troubles and death. Skilful observers have claimed that the agent is neither antiseptic nor bactericide.

v. Mosetig has modified his early practice. He now only spreads a small quantity of iodoform on the wound and covers this over with iodoform gauze. The objections to the agent still hold, however. I would recommend the following formula:

Iodoform,	gr. xv.–xlv.
Talc. venen.,	ʒ iij. 3 j.

Many substitutes for iodoform have latterly been proposed. In the first rank we note tetraiodpyrrol or iodol, as it has been called.

In 1885 iodol was prepared by Ciamician and Silber by the mixture of pyrrol (C_4H_5N) with an alcoholic solution of iodine. It is a yellow, odorless and tasteless, crystalline powder, almost insoluble in water (1 in 5000), in ether in equal parts, in alcohol in three parts, in oil in fifteen. It is not poisonous.

It may be used as a powder:

Iodol,	3 j. gr. xv.
Talc. venet.,	ʒ iij. 3 j.

As a solution:

Iodol,	3 ss.
Spts. vini dil.,	ʒ j.
Glycerin,	ʒ j. 3 vj.
Aq. distill.	ʒ iij. 3 j.

As a gauze:

Iodol,	
Colofonii,	ää gr. xlv.
Glycerin.,	ʒ j. 3 vj.
Spts. vini dil.,	3 iiss.
Aq. distill.,	ʒ iij. 3 j.

the gauze being impregnated with this.

As a collodion:

Iodol,	3 iiss.
Spts. vini rectif.,	ʒ iv. 3 vj.
Pyroxylini,	ʒ j. 3 vj.
Ol. ricini,	ʒ j. 3 vj.
Aether sulph.,	ʒ ij. gr. xv.

In 1887 O. Lassar, Berlin, called attention to sozoiodol, proposed by Tromsdorff, of Erfurt, as a substitute for iodo-

form. Its empirical formula is $C_6H_2{}^{I}SO_3$ (OH), and in chemical structure it is paraiodphenolsulphonic acid:

$$C_6H_3\begin{cases} OH \\ SO_3H \\ I \end{cases}$$

It is a beautiful yellow, odorless powder, soluble in water and alcohol, not decomposed by light, crystalline, and not poisonous. It may be used in 5 per cent. solution, or in 5 per cent. mixture with chalk.

At present the price of iodol and of sozoiodol is higher than iodoform, which has latterly fallen very low.

Kocher has had less good results with his bismuth powder than Mosetig with iodoform. Still, in the clinic at Bern the results have been as favorable; elsewhere, however, bismuth is rarely used.

Lister has suggested the oxi-iodide, or sub-iodide of bismuth. This is a heavy, crystalline, reddish-yellow, odorless powder, not soluble in water, which Lister says is an excellent antiseptic against pus, and he prefers it to iodoform. It is not poisonous.

Since it is not soluble in water, it seems to me that the gauze is not to be recommended. The bismuth-salicylate, on the contrary, is stable when treated to alcohol and ether, the acid not being driven off as is the iodine in the former gauze. It contains one-quarter of its weight of salicylic acid and three-quarters of oxide of bismuth. It may be powdered over wounds even as iodoform.

A further substitute for iodoform is phenylsalicylate, proposed by Nencky. It is known as salol in medicine and has the formula:

$$C_6H_4\begin{cases} OH \\ COOC_6H_5 \end{cases}$$

It is a white, transparent, insoluble in water, slightly aromatic, tasteless, crystalline powder, which may be used over wounds in a 5 to 10 per cent. mixture. It is also used as a mouth wash.

℞ Saloli, ... ʒ j.–ʒ iiss.
Talc., ... ℥ iij.–ʒ iij. ʒ ij.
S. Externally.

℞ Saloli, ... gr. xlv.
Spts. vin. dil., ... ℥ iij. 3 j.
Ol. menth. pip.,
Ol. rosarum, ... ää gtt. 3
S. Mouth wash, ten to fifteen drops in a glass of water.

As before remarked, any soluble or insoluble antiseptic, if only mixed in 1 to 5 per cent. proportion with an indifferent insoluble agent, may be readily used as a powder over wounds. Such being the case the number of antiseptic powders has rapidly increased. Antifebrin, antipyrin, chinolin and its salts, kairin, thallin and its salts, and many other benzol derivatives, have been made into wound powders.

Finally, I would mention as an antiseptic the fluoro-silicate of soda. Its formula is Na_2SiF_6. I do not know who first called attention to the antiseptic properties of this inorganic body. I have obtained it from Engel, in Vienna, and have tested its bactericide properties. I prepared 2 to 5 per cent. mixtures of gelatin with the agent, sterilized it and then inoculated it with full-grown yeast spores. I began with the 5 per cent., and this remained free from germs; the same happened with the 2 per cent. These data establish it as one of the few inorganic chemical antiseptics. Owing to its difficult solubility it can only be used in 1 to 1.5 per cent. solution. It should be stated that in the text-books it is said to be readily soluble, but the specimen I obtained was only so to the extent of .8 per cent. Further researches may prove it to be of great value, especially in pediatrics and in gynecology, where, owing to its odorless and non-poisonous nature and to its cheapness, it might take the place of carbolic.

It may be used in solution:

Sod. fluor.-silici, ... gr. xv.–xxij.
Aquæ distillat., ... ℥ iij. 3 j.
S. Mouth wash.

Or in powder:

Sod. fluor.-silici, ... 3 j. gr. xv.
Talc. ven., ... ℥ iij. 3 j.

In an operation for adeno-sarcoma of the breast and in case of many ulcers the above powder was very satisfactory. I strongly recommend it to the experience of others.

Possibly, silicium tri-iodide (Si_2I_6) recommended by Friedel, and silicico-iodoform ($SiHI_3$), might be of surgical utility.

It is apparent from the context what a large number of antiseptics are at the disposal of the surgeon. It is certainly easier to discover a new antiseptic than to find the requisite number of wounds on which to test the new antiseptics. It would take more than ten years to weigh the value of those we already have. In these pages I could only refer to those best known and most useful to the practical surgeon.

Antiseptic Dressing, Drainage, Suture, Permanent Dressing and Kreolin.

All modern surgeons have the same aims in their dressings. The wound should, if possible, not suppurate, and there should be no secretion, but if suppuration cannot be prevented then decomposition and fermentation should be guarded against. The dressing, further, during union, should protect the wound against the entrance of microbes and also against various other harmful influences.

These aims may be reached in a number of ways.

A small number of surgeons use the simple iodoform gauze dressing. The surroundings of the wound are painted with iodoform collodion (1 to 10 or 15). In the wound a rolled piece of iodoform gauze is laid; the wound is then covered with ten to twenty folds of the gauze, over this a layer of absorbent cotton about 2 inches thick, and then a strip of muslin is rolled over all. A few surgeons use pure iodoform powder or a mixture with zinc-oxide, magnesia, chalk, etc.; others use pure salicylic acid or a mixture of this with zinc-oxide, etc.; others salol, and other bactericide substances. Over the powder they lay gauze, absorbent cotton, and fix all in place with gauze or an ordinary roller bandage.

The majority of practicing physicians use the sublimate dressing in the same way as formerly the carbolic and salicylic dressings were used. To carry off the secretion from the wound for one to six days, one or more drainage tubes are placed in the wound. Over the wound a thick layer ($\frac{1}{2}$ inch) of a 1 per cent. sublimate gauze is laid; over this a layer of absorbent cotton; over this a piece of mackintosh or gutta-percha paper; and all is held in place by a roller bandage.

Before I proceed to a description of the various antiseptics I must say a few words about drainage.

It is well known to the older surgeons that in pre-antiseptic times the number of cases of suppuration and of pyæmia was considerably lessened by the introduction of drainage, and that even the advent of the antiseptic era could not entirely banish drainage. I consider, therefore, the drainage tube an excellent antiseptic adjuvant.

Many attempts have been made to substitute something else for the rubber drainage tubes introduced by Chassaignac. Hueter has recommended silver and glass drains; Lister, horse hair; Watson-Cheyne, catgut; I have used goldbeaters' skins rolled together like a tube, and asbestos lint; Gersuny, iodoform threadlets; Billroth, iodoform-tannin pencils. All these, however, have not been able to displace rubber drain tubes.

Since drain tubes are used as antiseptics, it may be thought that these should, or must, remain in place till union is complete. Not so; in the majority of cases they have played their part in one to six days, and they may then be removed.

The fact cannot too often be emphasized that of all animal albumin-containing fluids the serum from the surface of wounds most readily decomposes, and that only the first stage of this process bodes ill to the health and the life of the wounded subject; and further that the drain tube answers the purpose of carrying away from the wound the serum which collects after any injury. Drainage tubes are, therefore, only requisite in the period which precedes suppuration—that is to say, during the first six days after the injury.

While in use the drain tube converts the occlusion method of treating wounds into a partially open method. When the period of suppuration has become established, then the drain tube is not only not necessary, but it becomes a foreign body and prevents union. The drain tube left *in situ* too long is even as harmful as the too strong application of carbolic acid, and should, therefore, be forbidden. Only exceptionally is it desirable to leave the drain tube in during suppuration; when, for instance, there is sacculation of the pus, then will the tube answer the purpose of preventing this. Retention of pus, however, is an abnormal process in a wound, for when matters are progressing favorably this should not occur. Formation of pus and depuration in normal cases balance one another; only

abnormal irritation increases the wound secretion and this may lead to retention of pus.

Retention of pus, then, in normal cases must be considered an exception. These exceptions, however, cannot formulate any rule for normal cases, and in the latter, then, the tube should be removed in from one to six days.

The use of the drainage tube is unnecessary in the following cases:

In the open wound treatment.

In case of flat wounds, where the dressing can soak up the secretion and carry it off.

In cavity wounds, which can be thoroughly tamponed and thus are converted practically into flat wounds.

In cases where the intention is to bring the edges together only after the lapse of one to three days.

Ten to fifteen years ago, when I used the écraseur and the cautery a great deal, I came to the conclusion that in order to obtain union by first intention sharply defined wound-margins were not essential; for the margins cut by the écraseur or by the cautery knife healed as readily. I have also brought suppurating wounds together by suture, without first freshening the edges, and I have often thus obtained union in suppurating wounds of the face. I have also obtained union by the insertion of sutures twenty-four to forty-eight hours after the operation.

The late suture, that inserted during the stage of suppuration, is called the secondary suture. In the use of this, drainage may ordinarily be dispensed with. We must note the fact, however, that the secondary suture, which occasionally is to be preferred to the primary, is contra-indicated in laparotomy for reasons which need not detain us here.

After this digression I proceed to a consideration of the concentration and the preparation of sublimate. This is prepared with alcohol and glycerin, with salt and glycerin in varying strengths of 1 to 300 to 2000.

v. Bergmann, the first and the warmest advocate of sublimate, uses a solution of 10 parts sublimate, 500 glycerin, 1000 alcohol and 1500 distilled water, over about 70 yards of gauze; this gauze when freshly dried contains about ½ per cent. sublimate. Maase takes ℥ j. ℥ vj. of sublimate, 1 quart of boiled water, 6½ pounds of salt dissolved in 10 quarts of water; these are mixed, filtered, and to the filtrate 1200 parts of glycerin

are added. This solution will impregnate 270 yards of gauze. Lister uses 2.5 parts of sublimate and 1 part of salmiac to 5000 of water. When Koch determined that sublimate was effective in the strength of 1 to 20,000, and that solutions of 1 to 300,000 prevented the development of microbes, then it became apparent that solutions of 1 to 2000 to 5000 could be used for impregnating gauze. Some surgeons use a combination of all possible antiseptics. Iodoform, carbolic, salicylic, and sublimate gauzes are used together; others still use protecting silk, cotton, etc. Such a cumulation and combination is not at all necessary, and very expensive.

I must still refer to an antiseptic which is superior to others. The number at our disposal is indeed too great. v. Mussbaum collected 80 agents, and of these only a few were generally known. As early as 1865 I used creasote, and specially referred to it in my work on military surgery, which appeared in 1866. I used this agent exclusively up to 1873, for I found that it acted better than carbolic. In 1875 I gave it up because other surgeons deemed it inferior to carbolic. P. Guttman has latterly tested its antiseptic properties after Koch's method, and I am pleased to find that he ranks it higher than carbolic. Carbolic acid is likely to evoke toxic symptoms; it injures the hands of the surgeon and takes the edge off his instruments. For awhile it was replaced by salicylic acid, and then these by iodoform; the latter, on account of its odor and its tendency to affect the intellect, was replaced by the long-known sublimate.

We possess now another antiseptic which may displace all hitherto used antiseptics, even carbolic and salicylic acids, iodoform and sublimate, and this is kreolin, a preparation obtained by dry distillation from English coal, which has the following characteristics: It is absolutely non-toxic in man and the higher animals, but for the microbes it is ten times more deadly than carbolic acid; it is soluble in water, alcohol and glycerin; it controls hemorrhage and pain; it limits suppuration; it injures neither metals nor the hands, but cleanses, disinfects and preserves both; it is very cheap. So far no disadvantages have been determined. We trust therefore that it will soon be accepted in surgery.[1] As to how long it will hold this position in this age of progress it is not possible to say.

[1] See the "Internationale Klinische Rundschau," Nos. 1 and 3, 1888.

In these pages we have always spoken of gauze for the dressing because it is the most convenient. There are many other agents, however, which are used as dressings. As to whether one or another is resorted to will depend on the choice of the individual, the question of cost, etc. All the materials in routine use are readily sterilized and impregnated with antiseptic fluids.

A few words now in regard to the change of dressings.

In the days when it was the belief that salves, plasters and topical applications had an active influence in causing union, it was deemed requisite to change the dressing frequently, and since then pus was considered to interfere with healing, the aim was to wash this away by permanent irrigation or warm baths. The bad results obtained from the latter means led surgeons to a simple change in the dressings, in private practice three to four times daily, and in hospitals once to twice. To change the dressing less than once was considered bad practice. When in 1859 I was called upon to attend so many serious wounds that it was physically impossible to change all the dressings daily, I divided the wounded in two groups, and in one or the other did not change the dressings for one or more days. When I found that the wounds which were left alone had a better appearance than those which were changed daily it became my custom to re-dress all wounds less frequently, that is every second to fourth day.

After I had used creasote for six years I was able to obtain union of large wounds by only dressing three to four times. I have since followed this practice, having learned that frequent change was injurious and unnecessary. I even went so far as to leave the dressing untouched for ten to fourteen days and then found the wound nearly or entirely healed.

A few years ago Neuber gave to this method the name of the permanent dressing. The child having been named, surgeons have considered the method a legitimate one in the treatment of wounds. It remains, then, only for me to state the limits of time during which the dressing may remain. For the present neither the days nor the weeks can be definitely stated. A permanent dressing may be defined as one which is only renewed when necessary, in opposition to the previous method where the change was made without stringent call, or because it was the custom to do so daily in order to ob-

serve the progress of healing. From my stand-point, rather than speak of a permanent dressing, I prefer the term obligatory change of dressing, as being more defining than the term permanent. The necessity or the advisability of a change of dressing depends on the following circumstances:

1. When the patient complains of pain in the wound or dragging, then, whether the dressing has been in place a few days or a few hours, it should be changed.

2. When the patient is feverish, loses flesh and strength without evident cause, then the dressing must be changed, since the source of the disturbance may be in the wound.

3. When neither pain nor fever but profuse suppuration is present; when, in consequence, the wound stinks and thus inconveniences and disturbs the patient, then must the dressing be altered, no matter how long it has been *in situ*. When the dressing is only soiled by pus without otherwise interfering with the patient, then it is customary to change the dressing for æsthetic reasons—although I do not grant the urgency here, for all a man has to do is to throw a roller gauze bandage over the soiled dressing without disturbing the wound and yet complying with the demands of æstheticism.

We desire to emphasize the fact that a change in the dressing before complete healing of the wound, however carefully this is attended to, carries with it still a greater or less irritation, and therefore this should, when possible, be avoided. The obligatory dressing outweighs any objection, and is stringently called for. In any individual case the limitations of a single dressing will be apparent.

Every form of dressing, and there are more than 100, gives equally good results. The majority of wounds heal under all these dressings by first intention. Aggravated wound disease is to-day rarely seen, and it must be granted that the doctrine of a contagium animatum has had a healthy and a beneficial effect on surgery and on humanity.

The Existence of Phagocytes, of Ptomaines and of Leucomaines are Essential Hypotheses for the Explanation of many Phenomena.

The good results obtained in the healing of wounds should not blind us in the search for the true explanation of the factor, and not cause us to abstain from the determination of the

truth. The fact that the so-called open treatment of wounds, where all sorts of micro-organisms have free access, gives as good results as the antiseptic occlusion method, evokes the query as to whether the conclusions drawn from the theory of a contagium vivum will apply to all the phenomena, and as to whether the observations may not receive their sufficient explanation from the stand-point of some other theory? There are a large number of phenomena which are not completely explained by the antiseptic theory. A few examples will suffice:

All surgeons are in accord in regard to the worth of iodoform in checking pus formation and in assisting granulation, while all observers agree that iodoform neither kills nor controls the powers of bacteria.

The inoculation of pathogenetic bacteria is followed by no results in many animals and in many men, while decomposed fluids which have been deprived of microbes by filtration or boiling retain their poisonous properties on the bodies of animals.

These and other facts render resort to other hypotheses necessary. One of these is that of Metschikoff, who, from microscopical examinations, evolved the hypothesis of phagocytes, which makes the object and aim of the white blood corpuscles to swallow and kill the bacteria. When the latter invade the body in very large numbers, when the bacteria in number and strength are more powerful, then the white blood corpuscles are killed by the bacteria.

Another hypothesis is the following: We have often referred to the fact that fermentation, necrosis and decomposition are the result of the action of micro-organisms. When microbes are lacking or interfered with in development, then neither fermentation nor decomposition occurs. It is supposed, then, that these microbes, which are nourished at the expense of the albumin of the body, are dissolved by it. In the process of this solution materials are formed, called ptomaïnes, which have the property, even as have alkaloids or poisons in relatively slight amount, to poison and to have a deadly effect on animal bodies.

Gautier has shown that in the discharges of entirely healthy animals, poisonous, alkaloid-like bodies are to be found which are not products of decomposition, and which he has called

leucomaines. He has found this alkaloid in the saliva, urine, etc., of animals. From the muscle of larger animals he has obtained five different crystalline alkaloids (leucomaines), which were very acid and acted as poisons on the nerve centres. These leucomaines belong to the ptomaïne group, and they are both found in animal bodies. Their number is now more than thirty.

According to these hypotheses it is not absolutely essential that decomposition bacteria should be brought to the body which is infected; it is sufficient if their products of decomposition are brought. The bacteria themselves may be killed or removed by filtration.

The existence of these ptomaïnes is testified to by such men as Panum, Selmi, Brieger, Nencki, Bergmann, Schmiedeberg, Zuelzer, Sonnenschein, Guareschi, Mosso, Gautier, and others.

The Present View of the Action of Microbes.

From the foregoing, the present opinion in regard to the influence of microbes on the development of inflammation, of suppuration and of wound diseases may be gathered. This view, in its present form, was not reached of a sudden, but has slowly developed, and it will not probably remain as at present established. A long time elapsed from Hueter's personally expressed opinion that neither inflammation nor suppuration could occur without the action of monads to the finding of the staphylo- and strepto-coccus pyogenes and their acceptance by surgeons. We must still point out how the theory of a contagium animatum began to spread, and what influence the change of opinion had on our present view.

It is and remains a fact that micro-organisms can cause wound diseases; the query now is how they do this? It is claimed that this occurs through their unlimited increase in a mechanical way, through stoppage of capillaries, or through solution of albumin, or in a chemical way.

According to the teachings and the axioms of physiology, however, mechanical and chemical agents do not act directly on the body. All processes in man, as in animals, in health as well as in disease, progress only under the influence of nerves. It is the sympathetic nerves, the vaso-motors, which actively contract and dilate the capillaries, and thus render the lumina narrower or wider, and assist the diffusion of fluids or

gases, preventing or increasing this. It is the vaso-constrictors and the vaso-dilators which preside over interchange in the body, equilibrating the nutrition, or interfering with it, and thus leading to disease.

Local mechanical and chemical agents work only indirectly through the sympathetic nerves on the body; and the microbes can only indirectly work ill by irritating the sympathetic nerves into a diseased state. The entrance of bacteria into the body and their residence there and means of support, effect an irritation which the sympathetic nerves receive, and this leads to afflux of blood to the irritated part owing to the dilatation of innervated capillaries. The congestion, the stasis, the altered local diffusion and nutrient phenomena, are the natural consequences of the local irritation, and when this local irritation with its consequences is of long standing, then general disturbances of nutrition occur in the body—that is to say, diseases.

At once we see that this view of the cause of wound diseases is very similar to that of physicians of olden time. The early physicians claimed that inflammation, suppuration and wound diseases were due to an irritation of the sympathetic and trophic nerves, and that this led to a disturbance of the healthy equilibrium. To them the irritant was a mechanical, thermic or chemical one; to us the entrance and action of microbes in the body and the resulting nutrition changes are the cause.

The difference between these two views is that whereas the older physicians claimed that mechanical, thermic and chemical irritants caused disease, the modern physicians admit only microbes; they grant the effect of mechanical, thermic and chemical causes only in so far as these assist the entrance of microbes into the body; when the latter are prevented from entering the body, then neither mechanical, chemical nor thermic effects alone are able of themselves to cause inflammation, suppuration and wound diseases.

Consequences Resulting from the Prevailing Theory.

It might seem as if the prevailing theory, which states that the microbes are only to be regarded as irritants of the sympathetic and trophic nerves, does not assist our pathological knowledge or the truth, seeing that the manner in which the

sympathetic and trophic nerves alter the calibre of the blood-vessels, and thus assist or limit the diffusion of gases and of fluids, is as little known and explainable as the theory of the direct action of microbes on the tissue. But this is not so.

It is certainly progress in our knowledge of pathological processes when we recognize that the same factors which regulate the calibre of the capillaries and the nutrient changes in the healthy body act in the same way in the abnormal state of disease.

As to the manner in which the sympathetic nerves alter the calibre of the capillaries and the nutrient changes in the tissues, we do know something about this, and it is explainable. It is as clear and comprehensible as the process by which the dynamo in its 500 revolutions to the minute yields light, heat, chemical and mechanical work.

In both instances, by the working of the sympathetic nerves on the capillaries and on the nutrient changes, even as by the rotation of the dynamo light, warmth and chemical action result, we are dealing with what physicists call transformation of energy.

The view that the micro-organisms do not cause wound diseases directly, but only through the medium of the sympathetic nerves, is a still further advance in our knowledge.

Every layman knows that shame, anger, terror and disease may cause redness or pallor of the face, that the sight of certain foods and drinks, indeed even the mere thought sometimes, will excite the salivary glands to greater secretion and cause the mouth to be filled to overflowing. We know that anger causes the venom-glands of the snake to fill, and that from simple sight, smell or handling the corpora cavernosa penis becomes congested with blood and sometimes even the semen is ejaculated. That such effects are not due to the action of germs even the most rabid pangermist will grant; they are to be considered as due to the sympathetic nerves, which are irritated, and thence reflexively ensue changes in the lumina of the capillaries and nutrient changes.

Since we know, however, that sympathetic nerves may be irritated by various agents, and that as a result of any irritation hyperæmia, stasis and disturbances of nutrition may result, we cannot say that micro-organisms alone may give rise to such effects; we must thus express ourselves: Inflammation

and suppuration may be caused by the staphylo- and the strepto-coccus, but also by other irritants of the sympathetic nerves.

In medicine the error is not infrequently made of considering the great majority of logical categories as absolute, while in reality only a small number of them are. When, for example, it is claimed that a foreign body in the trachea will cause dyspnœa and suffocation, it must not thence be inferred that when dyspnœa and suffocation are present there is present a foreign body in the trachea. A tetanus or a paralysis of the essential respiratory muscles may give rise to dyspnœa and to suffocation, and yet the lumen of the trachea is not obstructed in any way. A paralysis or a paresis of the heart, whereby the blood cannot be driven through the lungs, or a great contraction of the capillaries of the lungs caused by muscarin, will also result in dyspnœa and suffocation, and yet the lumen of the trachea is patent. As a further example: The saying, "The rain soaks the ground," cannot be assumed as implying "when the ground is wet it must have rained." The wetness of the ground may also be due to a rising of the soil-moisture, to the overflowing of a pool or to other causes. The saying, on the other hand, that cold, that is, loss of warmth, causes a change in the consistency of water, and changes the fluid water into the solid ice, is an absolute one. When ice forms, cold must have been present in order to cause the change.

There exist but few absolute inclusive truths, and the conclusion that micro-organisms cause inflammation and suppuration does not belong in this category; inflammation and suppuration may follow on other causes than microbes.

The assumption that inflammation and suppuration may be present in the absence of microbes and be due to an irritation of the sympathetic nerves, explains how genuine inflammation and suppuration occur in entirely closed cavities, for the microbes could only reach these cavities by way of the blood-stream, and such a hypothesis is a difficult one to accept. When, however, in the pus of idiopathic meningitis, pleuritis, peritonitis and osteomyelitis micro-organisms are found, then these have either reached the closed cavity in the blood-stream or the micro-organisms have arisen within these cavities without getting there from the outside; or, finally, the small cor-

puscular bodies found are not true micro-organisms, but are the smallest possible particles of tissue, detritus, so to speak, which only in appearance resemble micro-organisms.

Neither of these three hypotheses can entirely satisfy us. Thousands of observations teach us that in the blood of healthy men neither micro-organisms nor their germs exist. We cannot say when, for example, a healthy individual slips on the ice and only splinters the tibia or bruises the skin and then suffers from a severe osteomyelitis, that the microbes have been carried by the blood-stream to the tibia and there have found a *locus minoris resistentiæ* and developed.

As to the view that microbes develop at the spot, all the evidence against the theory of a spontaneous generation speak. Although this theory cannot be absolutely negatived and banished, still it cannot be so frequently called upon as the frequency of idiopathic meningitis, pleuritis, peritonitis, osteomyelitis, etc., necessitates.

The third theory, that the corpuscular elements found in pus are not organisms, are not microbes, but the smallest possible particles of tissue detritus, remains still to be proved. On this question more light will be thrown when we speak of inoculation and transference of micro-organisms.

So much is proved that, aside from micro-organisms, still other irritants of the sympathetic nerves may cause abnormal action and lead to disturbances of nutrition which we call inflammation and suppuration.

What Demands will an Antiseptic satisfy in the Future?

The views just expressed give to the question of antiseptics an entirely different aspect. We do not exclusively require that antiseptics should have bactericide properties; we require only that they should protect the sympathetic nerves against abnormal irritation, or else that they should make these nerves unimpressionable.

According to this view the iodoform controversy seems useless. If iodoform is a drug which can render the sympathetic nerves unimpressionable to certain irritants, then will its healing power, its ability to check suppuration, its antitubercular property be clear, even though it lacks all bactericide action.

There are doubtless many other drugs and agents which have no further action on bacteria, and yet are most useful healing factors. Perhaps massage, perhaps irrigation of the field of operation are, in that they protect the sympathetic nerves against abnormal irritation and make them unimpressionable. This view explains why in pre-antiseptic times even so many wounds healed by first intention, and we find these methods in the older works on surgery laid down as assisting the healing of wounds. It is noteworthy, too, that in 1884, Lawson Tait reported 139 ovarian and parovarian cysts removed by laparotomy without a single death, although he did not use any antiseptic in these operations.

In these pages surgical wounds and diseases are chiefly treated of, but we must state that the theory of germs has also been applied to internal diseases and even earlier than to surgical. Tuberculosis, cholera, typhoid, croupous pneumonia, recurrent fever, malaria, gonorrhœa, syphilis, certain skin diseases, tetanus, etc., each has a supposititious micro-organism which causes the disease. Of the above diseases only the tubercle bacillus discovered by Koch, the cholera or comma bacillus, Obermayer's spiral bacillus, Neisser's gonococcus, are the unquestioned causes of tubercle, cholera, recurrent fever, and gonorrhœa. The assumption of a typhoid, malaria, and tetanus germ, as also that of croupous pneumonia and of syphilis, while plausible is not yet proved, and daily we see physicians in search of the germs of other diseases.

I would here remark that in internal medicine also the majority of logical deductions are not absolute.

Even in case of tuberculosis and of cholera, which unquestionably may be produced by the tubercle and comma bacillus respectively, we must grant the possibility of origin in another way than through these bacilli.

For each of the infectious diseases without exception there is supposed to be a bacillus, but it has only been determined for a relatively small number; even though, however, we knew the bacillus of each disease, we would not therefore have acquired as yet any assistance in the therapeusis of these diseases.

We are able to prevent wound diseases by an antiseptic operation and by antiseptic dressings, since thus we shut off the natural and only mode of entrance into the wound. In

internal diseases, of bacillary origin, the manner of entrance of the bacilli is not known. They may enter the body through the lungs during respiration, by the intestinal tract, by an insignificant abrasion of the skin. We cannot, therefore, prevent their entrance into the body.

In case, however, pathogenetic microbes have gained entrance into the body, then is it more difficult to kill them than when in a wound. The internal use of bactericide agents is in its working very unreliable and occasionally injurious to the body. Cantani has suggested as a method of treatment of bacillary diseases the inoculation of material not dangerous to man in order to kill or render harmless the pathogenetic bacteria. As long, however, as a genus bacteriophagus is unknown such a proposition must remain therapeutically useless. We must still be satisfied, even as in the pre-bacteria age, with the control of single symptoms.

The Dawn of a New Era, which will have Greater Influence on Medicine than Bacteriology.

I will not pursue this question further, far exceeding as it does the limits of my paper, since we are on the threshold of a new era, when our views will suffer an essential change. The facts we are going to note will exert a far greater influence on physiology and pathology than has the doctrine of bacteria.

I will not theorize, but will stand firmly on the basis of observation and of fact, stating the consequences which may result.

At present we agree that blood consists of blood-serum and of three corpuscular elements—the red corpuscles, the leucocytes (the white blood corpuscles), and the hæmatoblasts.

The red corpuscles are the carriers of oxygen; when they come in contact with the muscles, glands and nerves, they give up their oxygen and take away the carbonic dioxide, and are the most essential sustainers of life and of tissue interchange. The hæmatoblasts constitute the coagulating property of the blood outside the body; and in the vessels, after ligation, they form the thrombus.

The leucocytes are granted varying functions, among others that of yielding the material of formation of the red corpuscles.

What action these leucocytes play in pus-formation we have already noted. They are granted an active part in the growth of tumors and in acute inflammations.

This glance at the composition of the blood shows us the groundwork of the physiology of to-day, and is the Ariadne-thread which leads us along the dark labyrinth of pathology. In the past few months the foundations of physiology have been shattered and the thread has been cut.

A. Mosso, who has carefully studied the blood of amphibia, birds, and man, by maceration of the blood in gastric juice, reached the same result as Rollet and Wooldridge, that the red corpuscles consist in an external envelope, in a fibrillary granular substance, and in a nucleus. The nucleus lies in the middle, and with tuft-like projections holds the external envelope fast; by the swelling of this envelope the insertion points of the nucleus look funnel-shaped. Between the envelope and the nucleus a layer is seen which consists of at least two porous substances which normally are homogeneous, but through change in the blood corpuscles this layer separates into two parts, a transparent and a yellowish hæmoglobin which also contains a slightly granular substance.

The red blood corpuscles change most readily, so that special care and expertness is needed to see an unaltered one under the microscope. Even disturbance by the object glass will alter them. This changeability varies with the animal and under the influence of different reagents. Even in the same animal corpuscles of varying strength and power of change are found. The stronger far outnumber the weaker. The difference in proportion between these two speaks for the strength and constitution of the animal.

The changes of the red blood corpuscles are manifold and up to now have been overlooked; and yet not overlooked, for they have been carefully watched and described, but the inferences have been false. In case of such sensitive and changeable bodies as the red corpuscles, the experiment of Cohnheim of stretching the mesentery of a frog under the microscope necessarily leads to error. Diapedesis affects readily and frequently the red corpuscles, the white less so.

The coagulation of the blood outside the body and in the vessels is only the consequence of the changes of the red corpuscles—that is to say, those which have the least resisting

power, which break up into hæmatoblasts (Hayem, Bizzozero). Frequently enough in the coagulum or the thrombus strong, unaltered red corpuscles are found included.

A further change in the red blood corpuscles is a swelling, loss of color and formation within them of small and coarse granules; another step in the change consists in a translucency of the envelope of the swollen corpuscles, and at times we may witness a linear division. White blood corpuscles, pus corpuscles, and hæmatoblasts do not have any special shape, they are only altered red blood corpuscles. The corpuscles seen in pus are only changed red corpuscles which have migrated.

The changes of the blood corpuscles are not to be considered as stages of growth, of life, but as a death, a necrobiosis.

We may recognize the changes in strength of the blood corpuscles and the degree of their limit of life.

Healthy, unchanged red blood corpuscles cannot be colored, while all altered blood corpuscles according to the degree of change may be colored red in an eosin solution, 1 to 1000.

When the blood is defibrinated only the weaker corpuscles die and break up into hæmatoblasts, while in the defibrinated blood the strong corpuscles remain unchanged. Still the latter do not always remain unchanged. Babington claims that in oil, and E. Freund that in vaselin, the blood does not coagulate; Mosso says, however, that both oil and vaselin only retard coagulation.

When the blood is directly transferred from the carotid of a dog to the abdominal cavity of a fowl, or when defibrinated human blood is injected into the abdominal cavity of a fowl, or a drop is placed in the anterior chamber of the eye of a puppy, we note, although the procedures were strictly antiseptic, changes in the individual blood corpuscles, as though microparasites had gained entrance to them.

Mosso has determined from his researches that the phagocytes described by Metschnikoff, that the changes in leukæmic blood noted by Virchow, that the bacillary alterations of typhoid-fever blood reported by Eichhorst, that the changes in the blood of cancer patients determined by Sappey, that the microbe wandering in the blood of malarial patients which Marchiafava and Celli found, that these and other changes were due to a necrobiosis of entirely normal red blood corpuscles.

It must also be especially noted that Mosso is able to determine the age of the corpuscular bodies found in pus. The youngest are the colored and swollen blood corpuscles; as these grow older they become larger, finely granulated; later they are grayish, and then very large, hyalin, in which latter state they remain in the capillaries of the lungs, liver, etc., and disappear from the circulation.

These observations of Mosso's are in accord with those of C. Heitzmann, of New York, published in 1883, in his microscopical morphology. Heitzmann's views when published received much comment and adverse criticism, but Mosso's corroboration gives strength to their great practical value.

Heitzmann says: "For a number of years I have noticed that the elements which are found in catarrhal lung affections and in tuberculosis in its acute and chronic form, were very pale and finely granular. Later I determined that the decolored blood and pus corpuscles of strong men were coarsely granular.

"By a microscopical examination of the blood I am able to determine the constitution of any individual without knowing anything about him or his manner of life.

"Points of value may be deduced from the difference in structure of the colorless blood corpuscles and from other considerations. For instance, the number of colorless blood corpuscles in a drop of blood varies greatly with the individual, and in general it holds that these corpuscles are the more scanty in number the better the constitution. A sleepless night, further, suffices to increase them, and from this fact I have often in jest been able to tell physicians after an examination of their blood as to whether their practice was lively or not, for in the former event sleepless nights or the demands of, and anxiety about patients were at work.

"Catarrhal inflammations of the mucous membrane also cause an increase in the number of colorless blood corpuscles, and a chronic inflammatory condition carries with it an undermined constitution. The red blood corpuscles are in color differently pronounced in different individuals; the paler the color the more certain the presence of pallor of the face or of chlorosis.

"The red blood corpuscles only run together in rollers when the serum contains a large amount of fibrin; in the blood of

individuals in poor health the rouleaux are not found. In individuals of mean strength they are sometimes present and again they are absent.

"In individuals of poor constitution, who had just passed through a serious disease, I found as a rule as well coarse as fine granular colorless blood corpuscles, as also in originally healthy individuals attacked by some chronic affection.

"Indeed the microscope tells us so much in regard to the health of man, that we cannot dispense with it any more than with the routine physical examination.

"Many years of observation have taught me the truth of this.

"The difference in appearance of living matter varies with the differences in individual constitution. When in the urine, in the sputum, etc., pus corpuscles, or in a drop of blood colorless blood corpuscles, are found peculiar in one or another manner, then may the diagnosis of the individual constitution be made with certainty.

"When pus corpuscles resemble *a*, *b*, and *c* in the annexed figure, this is a sign of an aggravated tubercular or phthisical constitution.

"If pus and blood corpuscles like *d*, *e*, and *f*, are mingled with those like *g*, *h*, *k*, and *l*, *m*, *n*, then the inference is that a previously healthy constitution has become enfeebled by disease, and this the more the number of corpuscles resemble *a*, *b*, and *c*.

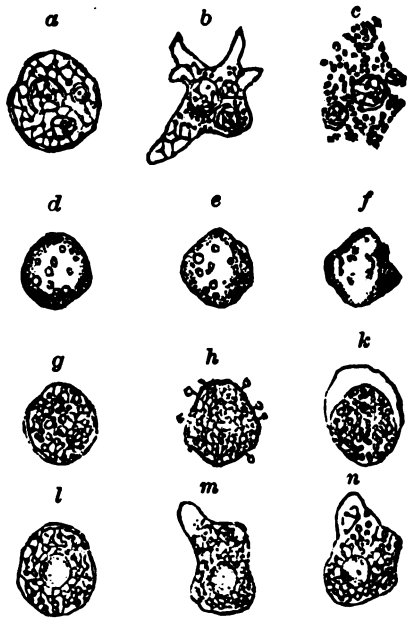
"Men of mean constitution when affected by chronic disease, or by factors which depress nutrition, have corpuscles like *l*, *m*, *n*, mixed with *a*, *b*, *c*.

"The presence of bodies like *a*, *b*, *c*, points only seldom and under the most favorable conditions to a long life; the more frequent the body *c*, the more certain it is that the end of the individual is near."

Mosso's observations, according to which pus corpuscles, the amœboid changes of the leucocytes, etc., are only red blood corpuscles changed in form, and are only different stages of disease and of death of the bioplasma of the red blood corpuscles—or, in other words, all the morphological elements found in the blood, in the lymph and in pus are only different degrees of the necrobiosis of the red blood corpuscles—these observations agree in every respect with Heitzmann's, and are preg-

nant of great practical value. The careful microscopic examination of the blood and pus is possibly for the practical physician and surgeon even as valuable from the stand-point of diagnosis and of prognosis as the determination of the tubercle-bacillus, the streptococcus, etc.

For examination of the blood a dear immersion lens is not necessary, nor an Abbe condenser, no coloring of the preparation, etc., but only the routine method and an ordinary microscope such as was used in the pre-bacterial era.



From the corroborative experiments of Mosso and of Heitzmann it follows that the blood and lymph corpuscles are very sensitive and changeable organisms, and that slight irritations, such as a current of atmospheric air, disturbance by the object glass, etc., are sufficient to kill or alter them.

Among the irritations affecting the blood corpuscles those due to the action of microbes play a prominent *rôle;* but it is one-sided to ignore all other irritants acting on the blood and the lymph corpuscles, and to lay the chief blame on the microbes. With the knowledge of the different kinds of irritants,

however, our understanding of disease processes has not increased; as long as we do not have a more exact knowledge of the different qualities which the protoplasm of the blood and of the lymph corpuscles suffer as the result of the action of various irritants, so long will the physiological and pathological processes taking place in the animal body remain in darkness. Here the ax is to be laid, and the way cut through which the light of observation may shine to disperse the darkness surrounding this question.

In case of the organs of sense the question is a relatively simple one, for the different irritants act in the same way. On the primary radicles of the optic nerve irritants cause only sensation of light. On the acoustic nerve different irritants only cause sensations of sound; on the gustatory and the tactile nerves the effects of all irritants are taste and sensation. Far different are the results on the single cells of the animal body, where different qualities of irritation cause different changes and movements of the irritated cells. A few examples will clear this.

Cienkowski has made some very interesting observations on certain monads in this connection. The vampyrella spirogyra is a small, microscopic, reddish, structureless amœba, which of all the water plants seeks only a certain alga, the spirogyra, as food, rejecting all others. It finds a spirogyra, sucks its contents, seeks another, and repeats the process. Other algæ, such as vaucheria, œdogonia, it rejects.

Cienkowski noticed the same behavior on the part of another monad. The colpodella pugnax feeds only on the chlamydomonas, seeks it and after sucking out the contents seeks another to repeat the process.

Now no one will claim that these monads act from choice; the processes are simple, the result of special irritants. The spirogyra affects the vampyrella, even as does the chlamydomonas the colpodella, and these monads are attracted to the action as it were.

But why wander so far when we can find far more convincing examples in our own bodies.

We know that the intestinal wall is covered by epithelial cells, that each epithelial cell is an independent organism, a living being, so to speak, with developed functions, which, even as the amœbæ and rhizopods, takes nourishment by active con-

traction, assimilates this and rejects what is not suitable. It has long been known that the mono-cellular being selects for its nourishment what is beneficial to it and rejects what is harmful or useless. We know that the intestinal epithelium has the property of selecting the fat drops from food, and of utilizing them later in the radicles of the chyle vessels.

The epithelial cell, further, selects the nourishment suitable for itself even as does the vampyrella. If fat drops and minute particles of pigment reach it, it selects the former and rejects the latter. We may even go further. In the digestion of albuminate by peptone a great variety of material in soluble form results—for instance ptomaïnes—which is not absorbed by the normal epithelium of the intestines.

Still more interesting is the property of the epithelial cell in the different glands; it takes certain material from the blood and neglects other material; the portion acquired having become broken up and altered, a portion of the new product passes through the efferent duct of the gland, and a portion returns to the lymph and the blood current.

The same process occurs in the tissue elements of the parenchyma of the glands, as, for example, in the liver. The products of digestion reach the liver through the vena porta; the glandular cells of the organ separate these products, and thus altered they are returned to the circulation. True enough portions injurious to the organism are emptied into the duodenum, and without entering the circulation, make the circuit a number of times from the intestines through the vena porta to the liver and again into the intestine until they are finally passed with the fæces; other material, such as an excess of sugar, is converted into glycogen in the liver and returned to the blood as needed, and this wonderful property of the epithelial and gland cells is only the result of irritation of living protoplasm.

Protoplasm, blood corpuscles, lymph and gland cells may become diseased, may be more or less sensitive to irritants. The partial or total disease of the red plasma results, then, in a partial or total disease of the organism. These small living principles, the blood, lymph, epithelial and gland cells are microbes, the biology of which remains still to be determined. Only when we have laid the groundwork, thoroughly sifted the essence, cause and quality, in short the causality of the

irritability of the protoplasm, only then will we determine from every stand-point the vitality, the life principle, the life strength.

We must, however, yield to no illusion. Owing to the limitations of our senses and the incompleteness of our methods of research, we cannot hope soon to solve the problem; we must ever be careful not to err in the final result. It is to be hoped that, by following out the road opened by Mosso and Heitzmann, by applying their tests to all elementary cells of the living organism, we may reach a soil containing in its depths rich biological truths, which need only be laid bare by careful and constant work. To all vigorous, unprejudiced workers in this soil I would say God speed!

THE TREATMENT OF SYPHILIS

AT THE PRESENT TIME

BY

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8—17

THE TREATMENT OF SYPHILIS

AT THE PRESENT TIME.

THE fortunes and changes which the treatment of syphilis has experienced in the course of centuries are almost as numerous and varying as the symptoms which syphilis may produce in the human body. Almost coincidently with the appearance of the disease at the end of the fifteenth century, mercury is found mentioned as a remedy against it. However long mercury has been employed as an antisyphilitic, general assent has not yet been gained by any doctrine concerning the utility of its administration, the results which it may produce in syphilitic patients, the period at which its administration should be begun and how long it is to be continued. In opposition to mercury, guaiac, sarsaparilla, smilax chinæ, sassafras and many similar remedies have been recommended in the course of time, but a powerful and worthy rival first arose in the shape of iodine which has been universally employed since the second decade of this century.

In addition to treatment with the remedies mentioned, the expectant treatment of syphilis, without administration of mercury, has repeatedly found adherents, and the claim has often been advanced that constitutional syphilis results from the use of mercury. Some physicians claimed to cure syphilis by hunger cures, cold-water cures, others by so-called syphilization or, more correctly, curative inoculation of chancre. If, without making any pretensions to completeness, we review the literature of our specialty since the year 1859, we will find views, that possess certain features in common, advocated by Baerensprung, Diday and H. Zeissl. Baerensprung claims that mercury exercises a curative action on all syphilitic lesions and

that it rapidly causes disappearance of the symptoms of syphilis. But, according to him, the further development of the morbid process is not prevented by mercury; the outbreak of new symptoms is only delayed and the entire disease protracted. Under these circumstances syphilis often passes into its tertiary forms and finally may become incurable. Baerensprung also expresses the following opinion: "Tertiary syphilis is not mercurialism, it is always syphilis, but a modified syphilis, syphilis in an organism changed by mercury, as has been made perfectly clear not alone by me, but also by Fernelius and others." In his article in the "Charité-Annalen" Baerensprung says: "Whatever treatment may be adopted, syphilis is a disease which impairs profoundly the entire organism. The cases of rapid recovery within a few weeks are rare exceptions. As a rule, a very gradual extinction follows, and this may happen with mercurial as well as non-mercurial treatment. The advantage of mercurial treatment resides in the fact that it rapidly ameliorates the individual symptoms of the disease and effects their recovery, but this is more than counterbalanced by a double disadvantage. Inasmuch as the mercury impairs the entire constitution, it favors the development of destructive local forms; by making the disease latent often for months and years, it delays definitive recovery. Non-mercurial treatment is often unable to prevent the severe and extensive appearance of the symptoms, particularly at the beginning of the disease, but it offers the great advantage that it never conceals the disease when it is not cured, and accelerates its definitive recovery."

Diday divides syphilis, according to the severity of its symptoms, in the following way: 1, syphilis which is only indicated (ébauchée, once among 93 cases); 2, feeble syphilis (53 times among 93 cases); 3, severe syphilis (29 times among 93 cases); 4, galloping syphilis (4 times among 93 cases); 5, tertiary syphilis or syphilitic diathesis.

Diday says: From 1838–1855 I treated my syphilitic patients according to the old routine, from 1855–1860 I systematically dispensed with the use of mercury during the existence of the primary lesion and the first outbreak of secondary symptoms. I used mercury only in exceptional cases, when the nature of the symptoms imperatively demanded it. Finally, since 1860 Diday, under the influence of these two forms of treatment,

has devised a method whose principle consists in giving mercury temporarily, not alone when it is indispensable, but whenever its administration appears useful. He declares his adherence to the belief that mercury is unable to destroy the virus of syphilis and divides the methods of treatment into "the regular method" and an "opportunistic method," which he practises. This opportunistic method simply purposes to aid the efforts made by nature to cure the disease and the action of hygienic conditions upon it. The "regular method" requires two or three times as long as the opportunistic method in order to effect recovery. Diday attaches great importance to the regulation of the patient's regimen in the widest sense of the word and emphasizes that each individual has his own peculiar form of syphilis because every one has his own mode of life. He also says that the mode of action of mercury is unknown and denies its preventive efficacy. The fact that the procreation of healthy children by individuals suffering from latent syphilis is often secured by carrying out mercurial treatment, he explains, not as a preventive action, but as the removal of a morbid symptom.

The following is the course of Diday's method.

As he denies a preventive action from the use of mercury, he does not administer it while the primary lesion is the only sign of syphilis. Among 74 syphilitics under his observation, 49 did not use mercury during the existence of the primary lesion, while 25 were mercurialized at this period. In those who had not been treated with mercury, symptoms of the condylomatous period developed 43 days after the appearance of the primary lesion, and 49 days afterward in the 25 mercurialized patients.

As regards the intensity of the further course of the disease, there was an almost absolute similarity between the relapses which occurred after more or less prolonged mercurialization, and those which appeared without this treatment, which is assumed to weaken the disease.

In the initial stage of syphilis, therefore, Diday never prescribes mercury unless he is compelled to counteract the disadvantages that may arise from a marked "perichancrous" induration. The latter he regards as the advance sign of severe syphilis. If a roseola appears fifty days after a "chancre parchminé" in a young vigorous individual, and he is in a

position to take proper care of himself, a favorable prognosis may be given concerning the course of the syphilis.

Apprehensions concerning the severity of the disease must be aroused by the following circumstances:

a. A long standing and large primary lesion.

b. A duration of the second incubation less than forty days from the appearance of the primary lesion.

c. Great weakness, despite a good constitution, during the prodromal stage.

d. When the first papular eruption is confluent, and attacks at the same time the chest and back, hairy scalp, palms of the hands, and soles of the feet.

e. When mucous patches appear at the same time as the cutaneous eruptions, without any special accidental and habitual cause, and when they appear at this time in places at which the mucous membrane passes into the skin.

f. When the enlargements of the lymphatic glands in the neck, etc., are abundant and long persisting.

g. When an old, feeble, nervous, lymphatic individual is attacked.

In the first case, the syphilis may sometimes recover under the influence of tonic hygiene without mercury; in the second case, it is well to give mercury, aiding it, at the same time, with tonic remedies. A judgment as regards the important point of the future of both cases will be obtained by the clinician from careful study, especially at the onset, of the later secondary symptoms, which are so variable in their intensity and duration. He will thus be placed in a position to solve this highly important question. In order to determine whether a case will recover spontaneously or whether specifics must be administered, Diday gives the following data: "Do the eruptions follow at short intervals? Do they occur at variable intervals? Do the eruptions appear in regions and at a time, when the hygienic and moral conditions are insufficient to explain their development? Do they occur without previous excesses? Do the mucous patches give rise to enlargement of the lymphatic glands? If there are symptoms which indicate an affection of the nervous system, then we must interfere even if there is only a single lesion and this indicates great intensity of the disease."

Relying upon his experience Diday, says that no results are

to be expected from the administration of mercury if it is given before the appearance of morbid symptoms or during an interval in which the organism is free from symptoms.

H. Zeissl advocated views similar to those of Diday, and we subscribe almost entirely to the opinions advocated by the former writer. Zeissl started from the standpoint that in many cases the remedies employed may have exercised no direct influence on the recovery of the syphilis, and that at least in a large proportion of recoveries which have been credited to the different plans of treatment, the results were due to the help of nature. He adopted the following plan in his clinic. From the patients received in his wards who suffered from the initial syphilitic sclerosis, he selected those who appeared to have a similar constitution, so far as this is at all possible in different individuals.

So long as the initial sclerosis alone was present and no trace of a secondary syphilitic affection was visible, all these patients were treated expectantly, with suitable regimen, the initial sclerosis being treated locally with some dressing to which a disinfectant or astringent property is ascribed, such as aqua calcis, carbolic acid, powdered iodoform, etc. As soon as the secondary symptoms of syphilis had appeared in the form of an eruption, one part of the patients selected were subjected to an inunction cure, iodine preparations were given to another part, and the third series, despite the appearance of secondary syphilitic manifestations, received no medicine or, at the most, a placebo like syrup. rub. idæi or aqua amygdalarum internally or inunctions with a bland ointment such as unguentum simplex or the so-called unguentum citricum (fat, wax and curcuma or some other yellow substance).

H. Zeissl thus found that recent syphilides yielded very rapidly to mercurial inunctions, sometimes even after ten to fourteen inunctions, but that in some cases these syphilides presented no change even after ten applications of unguent. hydrarg. cinereum.

He also found that the secondary forms of syphilis, under the internal administration of iodine, often yielded within fourteen days, often not until four to eight weeks or even later.

Finally, Zeissl also noticed that in those patients who were treated expectantly even after the appearance of secondary

symptoms, the eruption disappeared completely within a period of four weeks to several months, and that in very rare cases the syphilitic eruption disappeared spontaneously two weeks after its onset without any treatment.

These experiments made it possible to study the natural course of syphilis, without any disturbance from the use of drugs; and proved that syphilis is a disease which, despite the apparent regularity of its course, is very often atypical, that it requires sometimes a shorter, sometimes a longer period for its cure, and that it varies in different individuals according to their bodily constitution. Thus, Zeissl observed, for example, that in very anæmic individuals who became syphilitic, an extremely scanty, maculo-papular eruption appeared or that a pustular syphilide developed very rapidly.

He also established the fact that the initial sclerosis is constantly followed by an eruption at the end of six to eight weeks, but that the gummous syphilides rarely develop within less than six to twelve months after infection.[1] These severest forms of syphilis, however, occur much more rarely after expectant treatment, though they do develop occasionally after this as well as after treatment with mercury or iodine. By the expectant plan Zeissl disproved the statement of the antimercurialists that the severer forms of syphilis are produced solely by mercurial treatment. He also made other interesting observations. For example, he found that if mercurial treatment is adopted immediately after the development of secondary symptoms, relapses occur much more frequently and, as a rule, are more obstinate than after the expectant plan or treatment with iodine. The observation was also made that if iodides were given immediately after the appearance of a syphilitic eruption or if no drugs were used and the eruption had not disappeared at the end of four weeks, then a very small number (10 to 12) of inunctions of small quantities

[1] H. Zeissl treated a man of 35 years who at the time of his admission suffered from a sharply defined, gangrenous, initial sclerosis on the prepuce. The initial sclerosis was excised and at the end of twelve weeks a distinct gummous syphilide appeared, particularly upon the face. We have also seen, in a patient in private practice, that gummata appeared upon the general integument and the tongue sixteen weeks after infection. This patient had been subjected to a vigorous inunction cure six weeks after infection.

(2.0) of gray ointment sufficed to destroy the symptoms completely.

Relapses were also observed after the expectant plan, but they occurred much less frequently than when mercury was administered immediately after the outbreak of the first secondary symptoms. H. Zeissl also made the observation that when individuals, after the disappearance of the first eruption without the administration of drugs, were not attacked by fresh eruptions for a year, they could usually be regarded as entirely cured.

He believes that the cure of syphilis can be effected under the expectant plan of treatment, simply because syphilis, like the majority of curable diseases, can recover under suitable regimen, without the administration of drugs. In his wards we have seen syphilitic roseola disappear occasionally within three months and in two cases within two weeks, without any medication. The most obstinate syphilide, the papular (psoriasis palmaris et plantaris), particularly the miliary disseminated papular syphilide, does not disappear, without treatment, in less than two to four months, but often requires a much longer time for complete involution. Syphilitic acne, impetigo, varicella and ecthyma also require a similar period for spontaneous involution. Under the expectant plan the initial sclerosis requires, for complete involution, two months, often four to twelve months or even more.

Zeissl propounded the following views:

It is true that if an individual suffering from an early syphilitic eruption is subjected at once to mercurial treatment,[1] the morbid symptom existing at the time usually disappears very rapidly, but the syphilitic diathesis remains and is manifested particularly by hyperplastic lymphatic glands.

It will be noticed, however, that among one hundred individuals treated in this way, ninety-six on the average will be attacked by relapses sooner or later. In those individuals who have received mercurials internally or hypodermically at the first appearance of a syphilitic eruption, the relapses occur as often as after early inunctions; opaline patches on the mu-

[1] Clinical experience has taught us that the violent and distressing headaches which usually occur during the syphilitic eruptive fever, are relieved by no medication so rapidly as by three or four inunctions of gray ointment (two grammes).

cous membrane of the tongue, mouth and pharynx occur with special frequency after the internal or hypodermic administration of corrosive sublimate.

If we make a resumé of these facts, it appears that mercury, when given in the earliest phases of syphilis, causes very rapid disappearance of the morbid symptoms, but that relapses occur more frequently than after other methods.

The favorable results which may be attributed to mercury are, that it usually causes more rapid disappearance of the symptoms of syphilis than other specifics and that, when it is used two or three months after infection and the disease has had time to exhaust itself somewhat, very small doses (10 to 12 inunctions) suffice to cause the disappearance of the symptoms still present. As a matter of course, it cannot be foretold whether such a recovery is permanent. It is in the treatment of syphilis that less depends upon what is done than upon how and when it is done, and this is particularly true of the administration of mercury. The mercury is not the injurious agent, but the improperly selected period of its administration.

It is only when the expectant method and iodine treatment are unsuccessful that mercury should be used, and we will then find that the patients are not alone restored in a comparatively short period, but permanently, in the large majority of cases.

As regards treatment with iodine, H. Zeissl has found that, if the iodides are given after the first appearance of the syphilitic eruption, the latter disappears in four to six weeks, at the latest in three to four months, and that the iodides are suitable as a remedy in all phases and forms of syphilis. But relapses also appear after their administration; the relapses are observed after early treatment with iodides, but much less frequently than after early treatment with mercury.

When syphilis is treated expectantly, *i.e.*, when an antisyphilitic is not given to the patient after the appearance of the first secondary symptoms, the eruption requires, on the average, a period of two to eight months for its disappearance, while the initial sclerosis requires at least four months, often a year or more for its involution. Defluvium capillorum and enlargement of the glands often remained noticeable for a year; with the return of the growth of the hair the symptoms successively disappeared. Zeissl very rarely observed any

relapses, especially of a severe kind, when purely expectant treatment was continued until complete disappearance of the luetic symptoms. We can confirm this observation from our own experience.

Zeissl thus gave the preference to the expectant plan over the two other methods of treatment. He would have resorted to drugs only in dangerous or severe symptoms, were it not that the patients in private practice often demand rapid relief from the cutaneous affections which sometimes disfigure them, and if the rapid cure of the symptoms were not urgently required in hospitals on account of the great accumulation of patients. Moreover, hospital patients usually belong to the working classes and must be restored as quickly as possible to their work. All these circumstances induced him to proceed more rapidly in hospital cases and to give drugs at an early period. He began with iodine treatment, which stands next to the expectant plan in the infrequency of relapses.

The following was the usual plan of treatment in his clinic:

When a patient suffering from initial sclerosis was received, the treatment at first was local, whether the sclerosis was intact or degenerated.

The iodides were given as soon as a syphilitic eruption was noticed. It was only when the eruption did not yield to a six weeks' treatment with the iodides, that mercury was used, either Zittmann's decoction, inunctions of gray ointment or, in very rare cases, subcutaneous mercurial injections. Twelve to fifteen inunctions usually extinguished the symptoms.

Zeissl formulated his experience in the following dicta:

1. The expectant plan takes a long time to relieve the symptoms, but, in the majority of cases, it cures syphilis permanently. Syphilis relapses very rarely after the expectant plan, much less frequently than after early mercurial treatment.

2. Treatment with iodides is next in efficiency to the expectant plan. The iodides are suitable for all stages and forms of syphilis. Even the severest symptoms, such as iritis, disappear after its proper administration, combined with rational regimen, but much more slowly than after mercurial treatment.

3. When the symptoms do not yield to the expectant plan or to iodides, minimum quantities of mercury (Zittmann's de-

coction or nine to twelve inunctions of two grammes of mercurial ointment) will cause their disappearance.

4. In pregnant women the symptoms of syphilis offer more obstinate resistance than in non-pregnant women, especially if conception and infection occurred at the same time. The secondary symptoms usually do not disappear completely until the patient has been delivered. In such cases the treatment must then be continued with iodides or, if these fail, with a few mercurial inunctions.

It is a noteworthy fact that Sigmund, who has had such a large experience and whom no one will accuse of a prejudice against mercury, expresses himself in the following manner:

"From the data collected there follow, among others, these conclusions, viz., that after local treatment of the first forms of syphilis very slight secondary symptoms (often so slight that they escape the patient's notice) appear in a very considerable proportion (forty per cent) of the cases; that in addition there is another notable proportion (about ten per cent) in which there are only brief and slight affections of the skin and pharyngeal mucous membrane (erythema, papules) which disappear rapidly under suitable local measures without general antisyphilitic treatment and, at the same time, without any disturbance of the nutrition and general condition of the patient: finally, that the number of severe secondary affections after such an expectant plan is not greater than after early antisyphilitic treatment, but that, on the contrary, experience favors the opposite view." Sigmund says further: "After long-continued comparative trials of both methods of treatment, it becomes evident that general antisyphilitic treatment, when begun in the later period, effects more rapid and thorough results than early treatment which must be continued longer and must often be repeated. . . . Science and experience positively favor the view that the proper time for general antisyphilitic treatment is in the second stage of the development of syphilis and that even at this period it should only be begun on the condition that several systems and organs are attacked, or if only one of them presents severe forms, or finally if the nutrition and vigor of the organism are demonstrably impaired by syphilis. In affections of mild grades and in certain organs, suitable local treatment will suffice even during the second period of the disease." Sig-

mund declares that hygienic-dietetic measures and the consideration or treatment of other complicating constitutional diseases are indispensable in every stage and form of the disease. He chooses the remedy to be employed in the general treatment of syphilis according to the form of the disease and the individuality of the patient. He concedes the efficacy of iodine even in the papular stages.

Whether and when mercury should be given constituted the main question in the therapeutics of syphilis almost to the end of the seventies in the present century. Although no agreement has been reached concerning the period at which this treatment should begin, the use of mercury was very materially restricted, at least in Vienna, while its value as a curative agent was fully recognized. The question as to the beginning of mercurial treatment still remains sub judice, but two other points in treatment have become more prominent. These questions are: *a.* Shall syphilis be treated when the primary lesion alone is present? *b.* How long shall treatment of syphilis be continued?

The first question must be considered from two standpoints. 1. Can the cauterization of erosions after suspicious intercourse prevent the development of a syphilitic primary lesion; or if a distinct primary lesion is present, can its excision prevent the spread of the virus to the general organism? 2. Can this object be attained by antisyphilitic treatment; or, if we are not in a position to destroy the virus of syphilis by the earliest possible treatment, can we at least diminish its deleterious influence on the organism? This treatment is called preventive general treatment.

We will now consider the first point: 1. Since syphilis has been better known, attempts have constantly been made to find a remedy which offers protection against the reception of the virus and which makes the virus inert after its reception.

Charlatanry has extolled many agents for this purpose, but none has proved successful. The condom offers the comparatively greatest protection. If there is a suspicion that the syphilitic virus may have entered at any part of the general integument or mucous membrane, the prevention of further results can only be effected by those measures which are used against other deleterious infecting substances (virus of glanders, hydrophobia, and chancroid). We most attempt to destroy

the virus and the tissues affected by it, by means of deeply spreading caustics. We have been taught by countless experiments on chancroid virus that it can be made innocuous to the organism if its site of reception is thoroughly destroyed within three days after inoculation. But the period within which the syphilitic virus can be destroyed by cauterization has not been ascertained by similar experiments. Inasmuch as it may be supposed that among so many excoriations after coitus, in which cauterization at the third day proved successful, the syphilitic virus may have acted occasionally, it might be hoped that it would be possible to destroy the syphilitic virus by cauterization and to render it innocuous within a few hours after inoculation. Years ago, Sigmund vigorously cauterized all points of venereal infection which came under his observation within a certain period, in the hope of protecting some individuals against syphilis. Although a number of these individuals became syphilitic, despite cauterization between the first and third days, Sigmund did not regard his experiment as useless, because the proportion of individuals who became syphilitic to those suffering from venereal diseases in general, was less when cauterization was performed than when it was dispensed with.

Caustic potash, Vienna paste, but preferably concentrated carbolic acid may be used for such cauterizations. Carbolic acid is preferable to nitrate of silver because the latter does not act so deeply and also forms a scurf which prevents accurate observation and retains the pus. Neisser also recommends concentrated carbolic acid. But we are rarely in the position to carry out these cauterizations for the prevention of syphilis because the patients usually do not notice the infection until a longer time after the infecting intercourse and until the product of the general disease, the primary sclerosis, is present. The cauterization cannot be performed with any great hope of success because Sigmund found that syphilis could not be prevented in a number of cases despite vigorous cauterization within one to three days after infection. We have repeatedly seen, in the course of our practice, that the initial syphilitic sclerosis with all its sequelæ developed in cases in which, according to the statements of physicians and patients who were worthy of belief, the cauterization was performed a few hours after the suspicious coitus. If syphilis does not

follow cauterization, which was performed within one to three days after the suspicious intercourse, we may not draw too positive conclusions concerning the efficiency of the treatment, because we do not know that syphilitic virus has really been destroyed by the cauterization. We possess no data which will inform us whether—even if we know that the infecting person is syphilitic—the individual who has had sexual intercourse with the former has really been inoculated with the syphilitic virus. This we can only learn after we possess more accurate knowledge concerning the syphilitic virus. But as such cauterizations can produce no bad results, it will not be improper, in suitable cases, to cauterize excoriations which are discovered within a few days after suspicious intercourse.

The second question is, What shall be done when a syphilitic primary lesion is diagnosed? Shall it be excised or shall general treatment be inaugurated at once?

As regards the removal of the primary lesion a favorable result from its excision will be expected only by those who regard it as a local morbid product, from which the infection of the general organism follows. We subscribe to the opinion that this lesion itself is the expression of general infection. Despite this opinion we have performed excision in a few cases without expecting any results. We were impelled to carry out this plan because positive results would have compelled us to change our opinion concerning the significance of the primary syphilitic lesion. In these cases (there were thirteen in all) multiple enlargement of the inguinal glands was present twelve times on the first appearance of the patient. In only one case there was no enlargement of the inguinal glands, and the ulcer, which was situated in the retro-glandular sulcus, was as hard as cartilage. In all thirteen cases a distinct syphilitic eruption appeared after a longer or shorter period. In two cases the cicatrix became indurated. As all these patients were seen in private practice, I have had them under observation for several years. I am able to say with regard to them that in not a single case could I notice that the excision weakened the course of the syphilis.

The experience and statements of the different authors who have written on this subject are very conflicting. This was shown clearly at the Eighth International Medical Congress at Copenhagen. We will here mention a few of the most weighty

statements. Wilks states that the results obtained by a commission appointed to study the subject of excision, showed that such a plan is useless. He mentioned that in the Dreadnaught Marine Hospital there could long be seen a jugful of chancres collected by one of the surgeons and then exhibited as proof of the uselessness of excision. Sigmund and Ricord also obtained negative results. Ricord says that the induration should be regarded, not as the cause, but as the result of the constitutional affection, and has recently spoken in decided terms against excision, in opposition to Leloir. He states that he has entirely abandoned cauterization or excision of the initial lesion, and regards its destruction at any time as absolutely useless. Syphilis exists as soon as the primary sore has appeared or even prior to its appearance. The outbreak of the disease would occur even if the penis were amputated on the appearance of the initial lesion.

Various authors have returned to this question in recent years and mention that they have obtained favorable results from the excision of the primary lesion. These results are said to consist of the absence of the secondary symptoms. Auspitz and Unna deserve the credit of bringing this question into thorough discussion. Among those writers who claim favorable results we may mention: Auspitz and Unna, Koelliker, Hueter, Chadynski, Ferrari, Schiff, Bumm, Pick and Vogt. Neisser declared himself, in Copenhagen, a firm adherent of the excision method. This method is opposed by H. Zeissl, Fournier, Lewin, Martineau and others. Mauriac, Leloir and J. Neumann obtained only negative results. Vajda has had no favorable results, and Bergh, of Copenhagen, puts no faith in excision. Its value must appear especially problematical when we remember that negative results were obtained in those cases in which excision was performed under remarkably favorable conditions.

Thus, Mauriac observed the development of syphilis in a case in which he performed excision fifty hours after the appearance of the primary lesion, although there was no enlargement of the inguinal glands at the time. This also happened to Leloir who performed excision in the foreskin fourteen hours after the development of the sore and twenty-two days after the suspicious intercourse. Undoubted secondary symptoms appeared six weeks after the operation. Fournier

observed a similar case. Suspicions concerning the value of excision must also be aroused by Angerer's case. On April 4th, 1880, eight weeks after infection, he excised an initial sclerosis which was accompanied by moderate enlargement of the glands. The patient presented no symptoms of syphilis; but his wife, whom he married Oct. 7th, 1880, aborted in the sixth month on April 24th, 1881; the child and placenta were not examined. The husband was subjected to inunction treatment with 100 gm. ung. cinereum and took 35 gm. potassium iodide. On April 16th, 1882, the wife again aborted in the seventh month of pregnancy. The mother and child exhibited evidences of syphilis.

Auspitz,who believed in the non-infectiousness of the buboes of the primary lesions, did not regard their existence as a contra-indication to excision. Th. Koelliker also says that the scleradenitis does not necessarily exclude the success of excision. Chadynski claims to have observed that syphilis did not develop despite the presence of adenitis. Folinea expresses a similar opinion, but says that general infection is more apt to occur when polyadenitis is present. Pick and Spillman observed no favorable results when the operation was performed in cases in which the adjacent lymphatic apparatus was affected. Bumm had an almost identical experience.

Bumm notably advanced the question of excision. He inoculated a healthy individual with the milky serum from two inguinal glands which had become swollen immediately after the primary lesion. After the development of a primary syphilitic lesion the individual exhibited a maculo-papular syphilide fifty-two days after the inoculation. This experiment led to the conviction that, if a favorable result is to be obtained, the operation must either be performed before the lymphatic apparatus adjacent to the sclerosis is diseased, or the glands must also be removed. If the operation is performed prior to implication of the glands adjacent to the initial lesion, we cannot be certain that a syphilitic sore really has been extirpated. In order to make a positive diagnosis, the long incubation, the moderate secretion, the indolent glandular enlargements, and the almost constant induration of the primary lesion must be taken into consideration. If excision is performed at a time when there are no indolent enlargements of the glands, such cases, if secondary symptoms do not ap-

pear, will be so much less convincing, because numerous excisions, performed under similar favorable circumstances by Pick, Mauriac, Fournier, Leloir, Keyes and others, have been useless as regards abortive treatment. On the other hand, the adherents of excision can claim, in regard to such cases, that we do not know the character of the extirpated part and that the syphilitic virus may have entered at another locality. Such claims may be made the more readily because microscopical examination of the early stage of a primary syphilitic lesion furnishes no absolutely certain means of recognition. But even if we advocate the view that the primary sore and the adjacent indolent buboes are not the expression of general infection of the organism, we may not place too strong hopes in the final result of extirpation of the glands when performed at the same time as excision of the sclerosis. Fournier had the opportunity of performing three autopsies upon individuals suffering from the primary lesion, and who had died of an intercurrent disease. From these autopsies it follows that the glands are attacked at the end of the first week (six to nine days) after the appearance of the primary lesion, and that, when the primary lesion is situated on the genitalia, the glands are diseased not alone in the inguinal region, but also in the iliac fossa and pelvis.

Hence the incentive to excision of the sclerosis and the adjacent lymphatic apparatus is so much less, because the coincident extirpation of the glands makes the operation quite a notable one. Moreover, the results of such operation have been very vacillating and the positive results are still open to criticism. At all events it is a noteworthy fact that the majority of syphilidologists who report favorable results, adhere to the unicist theory. The extent to which opinions still diverge and the absence of agreement on this point are best shown by a resumé of the views of a few writers.

Thus, Pick made the following statements at the Congress in Copenhagen: "The excision of the initial sclerosis is adapted, under certain rare conditions, to prevent infection of the general organism by the syphilitic virus. The most important result of the experiments in excision is the proof which they have furnished that the initial sclerosis constitutes only the local action of the virus, not the expression of the general disease, that the virus usually spreads from the initial lesion

through the lymphatics, and that there is therefore hope of reaching the virus in this path and making it innocuous."

J. Neumann writes: "As appears from these four experiments, we are unable to prevent general infection even by early extirpation of the sclerosis and lymphatic glands. The reception of the syphilitic virus by the blood is not even prevented by combining systematic antisyphilitic treatment. Nor could weakening of the constitutional disease be observed in any case."

Neisser expresses himself in the following way: "Even if some of the published cures are excluded on account of doubtful diagnosis, a certain number of excisions with positive results remain and appear to us to be convincing. Hence follows the conclusion that there is a possibility of treating syphilis radically by excision, of eradicating it at the very onset, although, as I willingly admit, the probability of effecting this end is comparatively slight and the degree of such possibility cannot be predicted in the individual case."

At a meeting of the Academy of Medicine held Nov. 9th, 1886, Cornil made a report on a paper entitled "précises par une série d'observations s'il existe un traitement abortif de la syphilis confirmé." He says: "The writer has collected 454 cases, of which 105 were successful, 339 unsuccessful. But in the cases described as successful the diagnosis of a syphilitic primary lesion had either not been made or could not be made, or the patients had not been under observation sufficiently long. The criticism made by the writer of this brochure upon the larger proportion of the cases, shows that some must be accepted with the greatest reserve and that the others cannot withstand criticism. The radical cure of syphilis by excision of the primary lesion must be declared perfectly useless and may even become dangerous if it is instrumental in preventing mercurial treatment." Cornil déclares that the brochure decides the question on account of the value of the criticism and the large number of cases analyzed.

It must be acknowledged that statistics decide against the method in question. Cases such as those of Mauriac, Leloir and Fournier, and the fact that weighty objections may be offered even to the favorable cases, lead us to doubt the results of abortive treatment and to state that, if there is a period of incubation in syphilis, it is very brief and that ex-

cision of the primary lesion does not prevent the development of constitutional syphilis, whether the adjacent lymphatic glands are swollen or not at the time of excision. We consider excision indicated only in so far as it rapidly removes a morbid focus which disappears slowly under general treatment. In addition, individuals in whom the secondary symptoms have disappeared while the primary lesion still exists, may be discharged more quickly from hospital treatment if the primary sore is excised. Perhaps more accurate, to be hoped for knowledge of the syphilitic virus will furnish the possibility for successful abortive treatment of syphilis.

We will briefly mention that the interruption or removal of the paths of absorption has been suggested and is also said to have been employed in order to prevent general infection. At the Medical Congress in Wiesbaden, 1886, Kaposi opposed this method. As little may be expected from the plan, practised by some writers, of destroying the virus of syphilis in the lymphatic tracts by injections of mercurial or iodine preparations into and around the glands nearest to the primary lesion. Lipp and others have employed this method. For example, Weissflog recommended injections of red oxide of mercury every ten to twelve days between the situation of the primary lesion and the groin. In several cases G. Lewin injected a weak solution of corrosive sublimate subcutaneously into the initial sclerosis of patients who did not yet exhibit general symptoms. Similar injections were made at the same time into the vicinity of the lymphatic glands. In two cases Lewin observed relapses, but the period which has elapsed since the beginning of these experiments is still too short to expect positive results.

We will now enter upon the discussion of the second point, viz., preventive general treatment. Here the opinions differ widely and we find prominent syphilographers of large experience among the adherents and opponents of this method.

Among the former we may mention Mauriac, Fournier, Jullien, Hutchinson, Cazenave, Drysdale, Ricord, Michaelis, Leube, Edlefsen, Baeumler, and Weber. Neisser who considers it still an open question whether general treatment shall be begun immediately after the assumed diagnosis of the initial lesion or not until the appearance of general symptoms, seems to favor preventive general treatment. Among the opponents of this method are H. Zeissl, Sigmund, Hebra, Kaposi, J.

Neumann, Baerensprung, Doutrelepont, Diday, Liebermeister, Sturgis, Rinecker, Bockhart, Finger, Bassereau, Lesser, Koebner, etc. Baeumler speaks in favor of the plan in the following words: "Preventive treatment, before secondary symptoms have appeared, is decidedly advisable for the reason that in the interval we can destroy a number of elements of the virus which would have given rise to as many primary affections in all possible tissues."

The opinions of the advocates of preventive general treatment is based upon the notion that mercury is an antidote of the syphilitic virus. This notion, however, is not founded on any known data. We only know that the symptoms of syphilis disappear upon the administration of mercury and the iodides, but whether these preparations really destroy the syphilitic virus or merely place the organism in a position to wage a more successful struggle against it, is an open question. Such reasoning would force us to conclude that mercury is also an antidote to cadaveric or gonorrhœal poison, because it also causes disappearance of the inflammations of the lymphatic vessels induced by these poisons. Whether mercury and iodides are really antidotes of the syphilitic virus will only be known when we are able to make pure cultures of the supposed micro-organism of syphilis and to study the action of these preparations upon them.

It is at least a striking fact that men of large experience, such as Hebra, Sigmund and H. Zeissl, who had practised preventive general treatment for so long a time, finally discarded it. In 1850 H. Zeissl expressed himself as follows: "As we have said above, the individual is constitutionally diseased from the moment at which the chancre indurates. It therefore requires absolutely general treatment which, when carried out properly, finally causes entire absorption of the Hunterian chancre." At that time Zeissl recommended corrosive sublimate for general treatment.

Kaposi says that "whenever he has been led astray by logic or external circumstances to adopt general treatment before the outbreak of the eruption, he has been sorry for it." He corroborates the experience often made by others and by ourselves that early treatment does not prevent the appearance of the general symptoms, but only delays them; that the symptoms appear irregularly and that mild eruptions no

longer occur exclusively, but there may be very early severe symptoms. Not alone is the development of severe symptoms, especially those affecting the central nervous system, accelerated, but in the rare cases in which severe early symptoms remain absent, injury accrues to the patient in so far as the syphilis runs a much slower course than when no early treatment has been adopted. Doutrelepont likewise states that he has not obtained any good results from preventive treatment. "Sometimes very disagreeable, gummous forms appeared, although the milder secondary symptoms had remained absent."

J. Neumann states that this plan is incapable of extinguishing syphilis at the root, but that it changes the localization. While cutaneous eruptions and enlargement of the glands predominate when there have been no preventive inunctions, after the latter we find that the mucous membrane of the mouth and pharynx, especially the lips and tongue, are particularly apt to present patches, despite the utmost care devoted to the mouth.

Koebner reminds us that, until the sixties of this century, no other method was known and practised that than of general treatment on the appearance of the indurated chancre. During his entire practice he has seen only two cases in which the outbreak of general symptoms apparently was entirely prevented. In all other cases syphilis ran its course despite even forced inunction treatment during the primary period; at the most the symptoms are somewhat delayed and abnormal. Unfortunately we have had repeated opportunity of noticing that those individuals, who received inunctions immediately after the diagnosis of the primary lesion or after the appearance of the first eruption, exhibited disproportionately early severe and fatal symptoms on the part of the central nervous system.

Jullien also calls attention to the unfavorable influence exerted by mercurial treatment on the nervous system, while Guentz attributes to it the development of albuminuria, nephritis and fatty degeneration, especially of the kidneys. But we must here consider another circumstance. We have convinced ourselves repeatedly that severe symptoms, affecting particularly the viscera, occurred in those syphilitics in whom the first eruption was very scanty, in whom the cutaneous

symptoms in general were slight, while those in whom the cutaneous symptoms were severe and extensive from the start, were attacked much less frequently by relapses, particularly by severe symptoms.

Baerensprung reports exactly similar experiences. He says: "Careful observers will not fail to have noticed the fact, which I have constantly confirmed for years, that patients in whom syphilis is manifested at the start by abundant eruptions, have less to fear afterward than those in whom the first symptoms were rapidly suppressed by mercury, while the disease was not cured, but merely made latent. I have seen the most severe and rapid destructions almost always in those cases in which inunctions were used against the primary or first secondary lesions."

These observations, made by Baerensprung, Doutrelepont, H. Zeissl and myself, would perhaps force us to the hypothetical assumption that the cure of syphilis is so much more easy and permanent, the greater the surface of the skin over which is spread the virus (which is contained, as inoculation experiments show, in every eruption). Perhaps the fact that the supposed micro-organisms of syphilis reach the cutaneous surface in large numbers places them under conditions which are unfavorable to their further existence and proliferation, and causes their extensive destruction without the intervention of treatment. It is not astonishing that complete harmony as regards preventive treatment and the treatment of syphilis in general cannot be secured, when we see one authority opposed to another. But it must cause surprise that in the therapeutics of syphilis writers remain deaf to the teachings of history. History clearly teaches that syphilitic patients did better when the use of mercury was lessened.

From our own experience with preventive general treatment we are decidedly opposed to it. The only result of this form of treatment with mercury is to delay somewhat the outbreak of general symptoms. Diday furnishes the statistics of 74 patients on this point: 49 had not, 25 had used mercury during the existence of the primary lesion. In the former the general symptoms appeared, on the average, $43\frac{53}{100}$ days, in the latter $49\frac{8}{10}$ days after the development of the primary lesion. Among the former the syphilis was feeble 17 times, moderately severe 27 times, severe 5 times; among the latter

it was feeble 6 times, moderately severe 14 times, severe 5 times. As a compensation for the few days' delay in the outbreak of the general symptoms, these run an irregular course and severe forms occur early. A further disadvantage of mercurial preventive treatment is the fact that the syphilis becomes more obstinate in so far as the symptoms of the condylômatous period yield much more slowly than if mercury has not been used until the appearance of this stage. We have therefore achieved nothing by preventive treatment except to weaken our chief weapon against syphilis.

We will now consider the second principal point, viz., how long should the treatment of syphilis be continued.

The fact that, whatever the plan of treatment, relapses may occur or such individuals may beget children who suffer from hereditary syphilis, proves that the relief of the symptoms does not always abolish the syphilitic diathesis. The question then arose, Shall the treatment cease with the disappearance of the symptoms and be begun again only when the symptoms return, or shall it be continued for a long time even if no symptoms are present? The latter method was developed particularly by Fournier, who gained many adherents in France and Germany.

As Caspary, who is an opponent of the chronic plan of treatment, showed, Fournier started with the belief that cases of syphilis, which are treated insufficiently or not at all, always lead to severe tertiary forms. But Caspary justly maintains that this assumption is false and is opposed to the experience of old physicians. Although not as ripe in experience as Caspary, we can confirm his statement. It is not true that all non-treated cases result in tertiary forms. We are acquainted with a number of patients who were treated by H. Zeissl on the expectant plan, are perfectly well at the present time, and have produced healthy children. Diday, who vigorously opposes Fournier's views, makes the following grouping of the changes in Fournier's therapeutic opinions since 1858. In 1858 he recommended six months' mercurial treatment, then three months of the iodides. In 1873 the successive intermittent method is recommended; 1, two months mercury; 2, then, no matter what happens, no mercury for a month; 3, then two months mercury, whether the patient presents symptoms or not; 4, three months without mercury; 5, two months

mercury, and so on for two years. In 1879 followed the continuous alternating method; eight weeks inunctions and iodides, then four weeks rest in order that the organism becomes weaned from the drugs, then six to eight weeks mercury, four to five months rest, four to five weeks mercury, and so on for about two and a half years. In 1880 Fournier required the treatment to be continued methodically and vigorously for three to four years, and Martineau wishes it to be continued even five years. According to Caspary, Denis Dumond pleads for the unlimited continuation of treatment.

Neisser is probably the most vigorous adherent of Fournier in Germany. He agrees entirely with him both as regards the mode of treatment and the duration as expressed in the statement: "The treatment should be chronic (two to four years) and should be carried out irrespective of the presence or absence of symptoms." He accepts this doctrine absolutely with all its consequences and regards chronic mercurial treatment as innocuous, and intermittent treatment as advisable. He differs with Fournier in so far as the latter recommends the prolonged administration of moderate doses (usually the feeble, uncertain protiodide internally), while Neisser insists upon a change from active, so-called main cures to milder, so-called auxiliary cures, in order that a large amount of mercury may be introduced and accumulate in the organism in a comparatively short time. The first cure should be especially vigorous and, if practicable, should consist of inunctions; these are regarded by Neisser as co-ordinate with calomel injections. Such a vigorous main cure should be repeated in the second, third and fourth years, even if all symptoms remain absent. In addition, in the first two years a mild auxiliary cure should be carried out with mild mercurials which possess the property of passing rapidly through the body. As a matter of course, local treatment is indispensable, and the use of baths, waters and sweat cures is also advisable. Despite his advocacy of this forced treatment, the writer lays special stress on sufficient intervals between the cures and attributes the occurrence of unusually severe symptoms to an excess of mercurial treatment. He naturally gives no rules for protracted treatment which hold good generally, because the physician must always individualize and must act according to the special properties of the preparation employed.

Bockhart and Finger also advocate the chronic treatment of syphilis. But Finger follows the therapeutic views of H. Zeissl, inasmuch as he allows the symptoms of the condylomatous period to undergo resolution, iodine being used when necessary, and only gives mercury when he cannot attain his purpose by other means. He does not regard mercury as a necessary antidote, hopes that all cases may run a spontaneous course, but nevertheless recommends small quantities of mercury repeatedly for two years.

In 1884 we stated that we thought it advisable not to discontinue the treatment of syphilis with the disappearance of symptoms, but to continue it as long as possible, at least a year, iodine being employed for the purpose. If no manifest symptoms of syphilis are present during this time, we order ten to twelve inunctions if the patients have special faith in mercurial preparations. We then stated that it was hardly advisable to administer mercurial preparations for a long time, say four to five years.

Kaposi says that "the more vigorous and persistent the treatment during the first acute period of the disease, the more certainly relapses and a protracted course are prevented." For this purpose he recommends inunctions, and, if these are impracticable, injections of mercurial preparations which have a permanent action. Kaposi says further: "The first treatment should be continued sufficiently long and carefully. The treatment should be repeated as often as real, *i.e.*, characteristic symptoms of syphilis appear (affections of the skin and mucous membranes, enlargement of the glands, etc.), but only under such circumstances. If there are no signs of syphilis, I regard treatment as superfluous. Why fight against wind-mills? Rational treatment, however, cannot harm otherwise healthy individuals, so that I am not opposed on principle to occasional repetition of treatment during the first year."

"In this respect J. Neumann's histological demonstration of cellular infiltration around the finest capillaries, which was found for months after a papule in that locality had disappeared, perhaps furnishes a reason for repetition of the treatment. But the action of mercurials also continues for months, so that every proper mercurial treatment thus becomes a protracted one and will exercise a curative influence on any

syphilitic tissues changes which may be present, even if invisible."

In 1884, Caspary opposed Neisser's views and regards the forced use of mercury as a not indifferent matter. While the cautious administration of mercury during existing symptoms of syphilis is invaluable, its action in latent conditions is uncontrollable. Caspary often observed severe relapses and affections of the central nervous system in patients who had received vigorous treatment. As it may be assumed that the syphilitic virus is incapsulated, so to speak, during the period of latency, we are so much more in the dark in administering treatment at this time, because we possess no criterion of the necessary amount of the drug administered. Caspary closes with the words: "A hundred cases of syphilis—a drop in the ocean; in addition their classification as regards treatment is purely accidental. I therefore forbear drawing any further conclusions. I need not emphasize particularly that I do not consider the results of my treatment as the best conceivable, that I desire nothing more fervently than to be taught and corrected by the better results of others. But those who have been treated according to Fournier's plan must have been under observation for a number of years and have remained free from symptoms. Despite statements to the contrary, I do not doubt that vigorous treatment at the onset delays relapses and I have already expressed the fear, based upon experience, that such relapses are apt to be especially severe."

In 1882, Sigmund wrote: "I have not opposed the occasional repetition of the treatment of syphilis with specific remedies, but that plan of treatment for which there are no well-founded indications, *i.e.*, the administration of remedies despite the absence of evidences of syphilis—a battle against a merely suspected, dreaded but invisible foe, who cannot be properly judged. Relapses, new forms of development of syphilis appear. These should be carefully scrutinized individually and then treated. Such a course offers a certain lever for the cure of the disease. Surely a more rational and humane method than that of the opposite party."

We thus see one authority opposed to another concerning the question of the duration of treatment. Perhaps the collective investigations now prevalent will further the solution of the question. For the present we will permit ourselves to

make a few remarks concerning continued treatment. Are its results really so brilliant? To this there can only be one answer, viz., no opinion can yet be formed. The method of treatment suggested by Fournier has been practised much too short a time. When a large number of patients, who can be compared with the number of those treated according to the symptomatic method, has been treated in this way and has been observed for fifteen years or more, then a final opinion is allowable. But to decide now in favor of the mercurial treatment which has been practised for years would be rash. From what we have learned from our own experience, the results would not be so very favorable. We believe, on the contrary, that Caspary's view, mentioned above, would prove correct. The fact that this syphilographer, who has had such a large experience, agrees with Diday, Sigmund and H. Zeissl, lends his opinion still greater weight. In accordance with our therapeutic views, we ourselves, urged by the patients, have adopted the continued alternating plan of treatment in only two cases. The results were unfavorable. The adherents of Fournier might interpose that both these patients were not treated during the existence of the primary lesion. I here give the history of these two cases.

H. K., æt. 22 years, an official, was supposed to have been infected September 30th, 1880, and on November 6th, when he came under my care, exhibited a characteristic primary sore. The patient was first treated expectantly, even for four weeks after a moderately severe maculo-papular syphilide appeared. Then potassium iodide was given four weeks and after the eruption had nearly disappeared, thirty inunctions āā 2.0 were made. From April to October, 1881, potassium iodide was given almost uninterruptedly. In this month a few papules appeared on the mucous membrane of the cheeks and tongue. Twenty-five inunctions āā 3.0 were made, and the potassium iodide contined until March, 1882. Then the patient took Zittmann's decoction for three months, and potassium iodide from June to October. A few papules appeared on the scrotum and mucous membrane of the tongue; twenty-five inunctions. From November, 1882, to May, 1887, the patient exhibited no evidences of syphilis. Every year, until November, 1885, forty inunctions āā 2.5 were made and the potassium iodide discontinued only when iodism appeared. Zittmann's decoction was

once given forty days, and hydrarg. tannic. oxydulat. thirty days as an auxiliary cure. At the urgent request of the hypochondriacal patient ten inunctions āā 2.0 were made in December, 1886. In February, 1887, ten inunctions āā 2.0 and potassium iodide almost uninterruptedly. In June, 1887, an apoplectiform attack occurred and the patient is still under treatment.

The second case differs from the first in so far as the patient was treated four years, but received no medication during the fifth year. Six years after infection—no relapse had appeared for four years—he decided on matrimony, first taking, as a matter of precaution, thirty inunctions āā 2.0 and potassium iodide for three months. Nevertheless the wife aborted in the fifth month of pregnancy, during the first year after marriage, and three weeks after delivery exhibited an extensive, small macular syphilide. No primary lesion was ever observed in the woman. Man and wife have since been subjected to antisyphilitic treatment and have passed out of our observation. We are convinced that with the more frequent employment of Fournier's method the reports of its ill success will not be wanting. It is difficult to see how the protracted use of mercury during the period of latency should furnish such good results, when it is unable to prevent the occurrence of relapses and the latter are continually recurring during the treatment.

Still another point remains to be considered with regard to mercurial treatment continued for many years. Is it really a matter of indifference whether a remedy, which often impairs the nutrition of the patient decidedly, is administered for four or five years? How unfavorably mercury acts on feeble organisms, especially on tuberculosis, could be seen when the attempt was made to treat tuberculosis with injections of corrosive sublimate. Hiller expresses the following opinion on this subject: "This is not a matter of indifference, particularly in doubtful cases of syphilis, because all antisyphilitic medication is known, as a matter of experience, to have a more or less depressing action. This is true particularly of the use of mercury, whether in the form of inunctions or subcutaneous injections, which always presupposes a certain degree of resistance and a good condition of nutrition on the part of the patient, but is poorly tolerated by feeble individ-

uals." Hiller reports forty-four therapeutic (antiparasitic) experiments in phthisis. "Extensive trial was made in forty-four cases with corrosive sublimate, partly subcutaneously, partly in the form of inhalations, partly by parenchymatous injections into the diseased lung. Among these patients the treatment could be completed (forty injections) in only one-half; in the other half it became necessary to discontinue treatment after three to twenty injections because the corrosive sublimate produced all sorts of disagreeable incidental effects or accelerated the loss of strength. In addition to stomatitis and salivation, the treatment had to be abandoned frequently on account of digestive disturbances, viz., anorexia, bad taste, diarrhœa; also muscular tremor, general weakness and insomnia. In advanced cases of phthisis, especially when the patients were confined constantly in bed and suffered from fever, the corrosive sublimate was very injurious. It increased the loss of strength and, as I convinced myself in several cases, accelerated not a little the fatal termination of the disease."

Unna believes that "the so-called syphilitic strictures of the rectum are to be placed in the same rank with the frequent affections of the gums and the rarer dysenteric attacks during mercurial treatment. Rectal ulcers, resulting not from syphilis but from mercury, are probably the cause of these strictures. The direct and remote effects of mercury are the results of reduction produced by the metallic, insufficiently oxidized mercury; the softening, ulceration and suppuration occur particularly in places where other reducing processes are also present, as in the mouth and rectum, where micro-organisms find abundant nourishment on account of bad teeth and coprostasis." These remarks are, at all events, worthy of note and, if proven correct, would show a hitherto unsuspected and dangerous action of mercury on the tissues. In addition we desire to add the following remarks. It is not advisable to employ gray ointment in large doses and irrespective of a beginning violent salivation, even in severe cerebral symptoms. Very sick individuals, who cannot take abundant food, usually run down very rapidly under mercurial treatment and often diminish very quickly in weight. In syphilitics who walked poorly, on account of the cerebral syphilis itself, we often found that they were hardly able to

stand after several inunctions. In some of these patients diarrhœa set in after the use of gray ointment, disappeared without treatment after the discontinuance of the mercury, and reappeared as soon as it was again administered.

The symptoms of progressive paralysis in syphilitics often appear to make more rapid progress under forced treatment with mercury and potassium iodide.

Rumpf reports as follows concerning his experience: "There are, however, isolated cases of cerebral syphilis in which mercury seems to exert an injurious influence. At least, in a few cases of mild delirium, its use was followed unexpectedly by stupor and this soon yielded to the administration of iodides. This phenomenon is still unexplained, but should not be neglected in treatment." Rumpf further states that mercury and iodides usually fail in feeble individuals, especially in hereditary syphilis of the nervous system.

When one has had experiences similar to those reported by myself and Rumpf, must not a dread of long protracted mercurial treatment be aroused? Is this not particularly true when Neisser, who battles so vigorously for chronic treatment (Fournier's successive intermittent treatment), says: "Mercury is powerless against such a large number of bacteria and, on the other hand, impairs the organism which has already been attacked by the syphilitic virus." He further says: "From all this the conception of malignity as the characteristic peculiarity of these syphilides follows of itself." We must accordingly abandon treatment with mercury in those very cases in which severe symptoms are to be treated—in which the disease is malignant—and must make our way with other remedies, such as the iodides or simple tonics. Is this not an indication that mercury should not be abused and that it should only be given when we absolutely need it? Is mercury injurious only in malignant syphilis and is its administration for almost five years a matter of indifference in latent or mild syphilis? We should bear in mind what Hoelder says of Torella: "In this respect the statements of Torella (1497) are interesting. He says that by his simple treatment he succeeds in curing the terrible disease quite rapidly and surely. He is astonished that so many patients are not alone cured, but even protected against relapses by his method, which, apart from strict diet, consists mainly of the laxative action secured by manna, tamarinds, and senna with aromatic substances."

We cannot refrain from quoting the apt remarks of Hoelder: "There is no doubt that its misuse aggravates the disease. The objections were really urged against the abuse of the remedy, not against the remedy itself. But as always happens, the exaggerations were attributed to the mercury itself, while the physicians should have reproached themselves. Because it helps in most secondary symptoms, it was expected to cure all forms of syphilis; when this failed, its use was increased and then the remedy was abandoned on account of its abuse. How often will this abandonment of mercury recur in the course of time? If we overlook the entire development of the pathology and therapeutics of syphilis, two points appear especially striking: in the first place, how slight was the influence exerted upon it by the various medical systems, how everything necessarily was subordinated to the conception of the virus, and in the second place how, in the main, all theories and fantastic notions were shipwrecked by the treatment."

These few hints suffice to show that long protracted mercurial treatment is not an indifferent matter to the general nutrition, and that it is hardly conscientious to expose a not perfecly vigorous and intact organism to heroic treatment on account of a perhaps still existing disease. We will give the following brief summary of our views on the most suitable treatment of syphilis.

Like every disease, syphilis may recover spontaneously after a longer or shorter period without the action of any drug. When this natural recovery occurs, it is often permanent. Permitting the disease to run its spontaneous course, with suitable regulation of the diet, is called the hygienic or expectant plan of treatment. Syphilis may also be treated with mercury, the iodides and vegetable remedies. There is no doubt that, in the majority of cases, mercury causes the most rapid disappearance of the syphills, but it is equally certain that, if mercury is given very early, *i.e.*, on the appearance of the primary lesion or the first eruption, while the symptoms temporarily present disappear very rapidly, much more frequent and obstinate relapses occur than when the syphilis is first permitted to expend its fury. In other words, when mercury is given early, it is as little able as the expectant or iodide treatment, to destroy the syphilitic diathesis in a short time and even delays the occurrence of

complete recovery. In our opinion, mercury should be administered, at the earliest, eight to ten weeks after the appearance of the first eruption, when the latter yields too slowly to the expectant plan or to iodides, or when dangerous symptoms appear on the part of the organs of special sense, the viscera, or the central nervous system. We adhere to H. Zeissl's opinion, "mercury is not the injurious element, but the improperly selected period at which it is used against syphilis."

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If the first syphilitic symptoms upon the general integument appear in the form of a macular or papular syphilide, we do not give antisyphilitics, even if there are degenerating mucous patches on the mouth and lips or tonsils, but attempt to relieve their painfulness and to induce involution of the patches by entire prohibition of smoking, by touching them with lunar caustic, by frequent application of tanno-glycerin (tannin 5.00, glycerin 20.0). If the symptoms have not disappeared at the end of eight weeks or if no essential improvement is noticeable, we give the iodides to the patient.

If the symptom-complex has not disappeared at the end of ten weeks more or even if they have run their course, we may pass to mercurial treatment without any bad results as regards the subsequent course. We favor particularly Zittmann's decoction or inunctions of gray ointment. In this way we usually need a smaller number of inunctions to cause the disappearance of the symptoms than when the mercury is used from the start. We rarely order mercury internally or subcutaneously. Injections of calomel are the most rapid and vigorous form of subcutaneous medication.

Although it does not belong within the province of this treatise, I will nevertheless report on a few cases which we have treated, since May, 1887, with Neisser's calomel emulsions. Since June, 1886, Neisser has used calomel suspended in oil with great benefit. This diminishes very considerably the pain of the injections and almost entirely prevents abscesses.

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tinued longer than is now customary. This is done in our method by aiding spontaneous recovery and only resorting to medicinal treatment after the former has done its work. As a matter of course, mercurial preparations can only play a subordinate part in treatment continued for half a year, a year or even longer.

That a patient is permanently cured of syphilis can only be maintained with some degree of positiveness when he remains well for one or two years after the disappearance of the last symptoms.

THE TREATMENT OF INEBRIETY

IN THE

HIGHER AND EDUCATED CLASSES

BY

JAMES STEWART, B.A.

Member of the Royal College of Physicians of Edinburgh; Licentiate of the Royal College of Surgeons of Ireland; Fellow of the Medical Society of London; Member of the Medico-Psychological Association, and of the Society for the Study of Inebriety; Formerly Surgeon in the Royal Navy.

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that the knowledge of having done anything conscientiously was in itself a reward, I doubt if I would be able to stand before you in the position I occupy by your favor to-day—a reporter, as it were, of reflections suggested during work still in progress.

And now, you may ask me, what is there in the disease of inebriety as it is found among the cultured classes to justify my devoting the time at my disposal to the consideration of such a small branch of the subject? I would answer by reminding every practical physician before me to-day of the great differences there exist in the types of *all* diseases according to the surroundings of patients, but of none more than of those suffering from nervous affections. And then, again, in reference to the treatment of the same type of nerve disease in different classes of patients, one is compelled to recognize the necessity of adapting remedies in a very elastic fashion to surrounding circumstances. The inebriate whose manner of life and daily occupations make him familiar, from his earliest years, with squalor and wretchedness has a physical constitution very different from that of the squire, who has been nursed in the lap of luxury from his infancy. What in the former case might be most suitable and effectual treatment would in the latter be simply absurd.

But here I find myself taking for granted that all the scientific world of medicine now looks upon inebriety as a physical disease, associated with loss of will-function—a loss implying, as I take it, a greater or less lesion of nerve tissue. I ought to have remembered that but a few months ago the editor of one of our leading medical weeklies, when alluding to the systematic lectures of Dr. Norman Kerr, spoke of inebriety as an "ailment." In the same article, however, there was quoted a paragraph in which no less an authority than Professor Bünge referred to it as the "alcohol plague." Between these two extremes is to be found what seems to me to be the true position.

I have little doubt but that, when our microscopists have made the discoveries which are foreshadowed already, it will be proved, to the satisfaction of the most exact pathologist, that in the case of every inebriate who dies before the *vis medicatrix naturæ* has had time to do its reparative work, an absolute *degeneration of certain brain elements* has

taken place. It will be found, I make little doubt, that this degeneration, this tissue change, is as decided as the result of slicing off a portion of the finger top while cutting a loaf of bread. The wise man who meets with an accident such as this wraps up the injured finger so as to exclude from the wounded surface what would interfere with the growth of new tissue, *i.e.*, with the laying down of fresh substance to replace what either has actually been bodily removed by the knife, or will, in the inevitable course of events, be lost by ulceration.

If we have a conviction that the pathology of inebriety is such as I have thus briefly hinted at, we may approach our patients of the cultured classes in a manner which will commend itself to their reason and understanding. And here I would interpolate the observation that in this power which pathological *convictions*, if not undeniable facts, put in our hands we have a valuable aid in dealing as physicians with an inebriate whose intelligence has been cultivated by higher education—help which is not available if we are dealing with those who have not had such advantages. But to pursue my analogy of the injured finger, or rather the finger from which a portion has been absolutely sliced at the top. The inebriate, we believe, has sustained an injury to his brain substance. We know by observation that there is certainly a loss of will-power in every inebriate without exception. We also know that the power of distinguishing truth from falsehood is invariably weakened in the drink-craver.

All that we can do as physicians is to *assist nature* in her efforts to regenerate the injured nerve tissue—to build up again the brain elements through the medium of which the will-power and other functions are exercised. What particular portion of the brain is used in the exercise of these faculties we cannot now say absolutely; but the researches of Ferrier and others may yet enable us to put our finger on the parts involved as certainly as we can now on the "centre for speech," and be equally positive as to the functions in relation.

If we could induce our patients to shield Dame Nature from interference while rebuilding injured brain tissue as carefully as they do while she is rebuilding skin or muscular tissue, the number of cured inebriates would be increased a hundredfold. One great use, in my mind, of a society such as ours is to bring before the public arguments in support of decided

views as to the pathology of inebriety, so that when a man or woman of education becomes the victim of the disease (call it "ailment" or "plague," whichever you prefer) the physician, on being asked what had better be done in the case, may find the ground somewhat prepared for him, and the patient all the more likely to accept as rational the mode of treatment based on such pathological dicta.

I am addressing to-day some west-end physicians. Let me suppose then that one of you gentlemen has before you an intelligent drink-craver who recognizes that he is suffering from a degeneration of nerve tissue. Let me take for granted that he has come to you of his own accord—that he has driven up to your hall-door in his own brougham—that while sitting in your consulting room he has detailed to you how he has, over and over again, resolved to loose himself from his enemy, and over and over again failed in the attempt; how he feels ashamed of himself when he recovers (temporarily) from the result of his yielding to the temptation to take what is ruining his health, destroying his prospects, alienating his friends—ay weakening even the ties of a life-long affection that binds him to the noble woman whom, in happier days, he had induced to leave the shelter of a joyous home in order to become his wife.

Listen to him as he goes on further to describe to you how the literary work, to which he had been devoting his leisure moments, and which promised to increase his reputation and add to his wealth, had been almost entirely given up; that when he settled down to his books and MSS. he felt much enjoyment in the work at first, but that his energy soon failed, and an irresistible impulse had led him to take a glass of brandy, just "as a fillip," which quickly lost its effect, and he had been compelled to call for more; how his wife with tears in her eyes had over and over again besought him never to touch the accursed poison; how he had promised her faithfully, earnestly, and honestly, to abstain entirely from even beer for a dinner drink, but that he found himself led to do what he had never done before—to deceive her whom he loved as the apple of his eye, and who was the mother of his darling children. Allow him to continue his tale of self-accusation interlarded, as it probably will be, with protestations that between the attacks (which are separated from each other by

shorter and still shorter intervals of time) he is able to transact his business, attend to his parliamentary duties, and proceed with his literary work as well as ever, remaining all the while a total abstainer. At last he will come to the point which took him to your consulting room and he will say:—"Now, doctor, I want you to give me some medicine that I can take when I feel one of these attacks coming on, something you know that will prevent my having that terrible crave." He will then confess to you that he formerly thought he could give up the accursed habit himself, when he pleased, merely determining never to touch alcohol in any form, but that he had at last found that without some help he could not carry out his resolution.

My advice to you is to address your M.P. friend somewhat in this wise: "My dear sir, you are suffering from an injury to your cerebral tissue. That portion of your brain which is used every time you exercise the will-power is affected. Alcohol is a poison which has what we call an affinity for that portion of the brain. It seeks out, as it were, that particular spot, and there exercises its destroying power. Now if you want to get that injured tissue restored; if you want"—and here you can take some spongiopiline or like substance from your drawer, and gouge out enough to hold a threepenny piece, then pointing to the depressed surface you may continue thus: "if, I say, you really wish to have the depression in your brain (as decided as the one you see here) filled up by new matter, it is *not impossible* to get the work done. But I cannot do it for you. No medicine that I could give you would prevent you from acting as you have told me you do from time to time *until the depression I have referred to has been filled up.* Dame Nature will do it for you, but you must give her fair play. If you had broken your right arm, you would have gone to your friend Sir William, who would have told you you must wear a splint and give up all writing for a certain time. Why should the surgeon tell you to submit yourself to this great inconvenience? Just that Dame Nature might do her reparative work *unimpeded.* Now in the same way that you would submit to going about with a splint made of wood if your arm were injured, so must you consent to going about with a metaphorical splint attached to you while Dame Nature is rebuilding the injured part of your

brain. That splint must be the company of some one who will prevent you from doing aught that will impede the good Dame in her reparative work. A single glass of the mildest claret, a tumblerful of the lightest ale taken while she is at her work may cause—nay probably will cause—the destruction of what it has taken her weeks and weeks, ay perhaps months and months, to construct."

The M.P. will probably smile unbelievingly, but you must stick to your guns and continue the attack, saying: "You look surprised, my friend, but were you as well acquainted with the way in which Dame Nature works as I am, you would cease to be incredulous. You would know that she is able to lay down new tissue only at a rate varying according to the part of the body where her reparative powers are called into requisition. You would know that inside that bone-box you carry above your shoulders she works *very slowly* indeed; and I'll venture to say that, if you consult a dozen of the eminent physicians of the day, at least ten of them will assure you that the brain, injured as I have told you I believe yours to be, cannot be repaired thoroughly unless her ladyship is allowed to work, without the slightest interruption from King Alcohol, for a whole twelve-month." When you get thus far you will hear the pet of the House of Commons' smoking-room utter a groan that betokens a feeling of despair. But you must not appear to notice this, merely saying, "Come now, my friend, when will you let the splint be put on?" His reply will probably be in the form of a question such as, "Won't it do if my wife goes with me abroad? She'll act as the splint you talk of." You say, "No, emphatically no. Willing though she may be, devoted as I dare say she is, she is the last person in the world to whom I would entrust the task of acting as your shield against your enemy." "Well! what about my son? he has just taken his degree at the University, and a year's travel will do him good before he settles down." You answer, "No! not one of your relatives is fit for the task. You must go to some country doctor who has made a study of the treatment of the disease you suffer from; some one who will be a pleasant companion in your walks abroad, and from whom, or his deputy, you must *never separate yourself* while you are within possible reach of your enemy; some one who has a cheerful gentlewoman for a wife, the

joyful mother of children who will make you feel 'at home' under her husband's roof, who will in fact give you some of the poetry of life to enjoy while your treatment is being carried on by your prosaic but kind-hearted physician—the friend to whom, if you are wise, you will submit yourself as absolutely as you would to the surgeon if your arm were broken. Try and find a doctor who resides at least a mile from a pawnbroker's shop; search for one who lives in a bracing locality, far from club, hotel or 'public,' a doctor who will take you with him on excursions in the summer (by road or rail or steamboat) and follow the hounds with you on foot in the winter; thus putting in good working order the boiler and pump and other fittings in the hull, while Dame Nature repairs the damage done aloft. Let him be, if possible, a man who has rubbed off the angles of his character by foreign travel, a man with a vigorous constitution so that he may take a ten-mile walk with you in the forenoon, play lawn tennis or billiards with you in the afternoon, and take a hand at whist or go to a meeting with you, or a concert, or some such-like divertissement in the evening. Above all things take care that he is a man of religious feeling who will sympathize with you as one fellow-sinner with another. Remember, too, that if he is an honest man and you ask him to receive you as his patient for three or four months only, he will decline and tell you that suppose a surgeon were to undertake to make a man who had broken his arm fit to pull an oar in six days after the fracture, he would be scouted from the society of his professional brethren, and that he too would deserve to be similarly treated if he undertook to cure in an equivalently short time an *injured brain*, with probably heart, stomach, kidney, and liver complications."

After you have thus addressed your patient he will say probably, "Well, doctor, I'll think about it; but I must first consult the chairman of my committee down in Mid Blankshire, and see whether he thinks my constituents would consent to my being a year absent from the House. Then there's the home farm to be looked after, doctor, and the book I am preparing for the press and my daughter's possible—well I may say probable—marriage to come off in the autumn, and a lot of other odds and ends that must be seen to by myself before I go down to your friend with the charming wife!

Good-by, doctor, you'll hear from me when I make up my mind!" But months and months pass without his making up his mind, albeit he has been to several physicians who have practically given him the same advice. His book is not progressing, his wife is getting worn out, even her sweet expression is being displaced by a look of half-frightened suspicion, and the old tale—the same sad sequence of events—is repeated. He at last consents to go for six months. Be sure you warn him that the foundation will scarcely be laid by that time; but trust to the wisdom of your medical friend, with whom you recommend him to live, that the latter will induce him to extend the period to the minimum time required if a permanent recovery is to be looked forward to.

Now we will suppose your patient has reached the "Home." What ought to be his treatment there? If the resident physician be a man of experience he will cut off absolutely and entirely from the very first all alcoholic stimulants, whether in the shape of beer or claret or anything else.

The depression from which inebriates are generally suffering when they first reach a home requires the frequent administration of egg and milk, beef-tea, milk and lime water, soda and milk and other easily assimilated beverages, taken every hour and a half at first and gradually reduced in frequency. The sleeplessness from which almost all inebriates suffer at first is best treated by a draught composed of twenty minims of the solution of bimeconate of morphia with ten to fifteen grains of chloral, alternated for a few nights with other hypnotics. I am in the habit of putting into the bed-room of any gentleman who suffers from depression and dread of impending death a small bed which I occupy myself for the first three or four nights. As the strength of body returns gentle exercise ought to be insisted on, increased gradually till at least eight or ten miles a day for a gentleman, or five miles for a lady, can be accomplished with ease. If the patient does not engage in literary work or has no hobby, such as painting, music, wood-carving, carpentry, or gardening, he ought to take up crystoleum work, photography, or some other easily acquired art or occupation. The first is specially useful, as the ladies of the family circle may join the gentlemen while at it. Photography is greatly liked by those who are induced to learn it, affording as it does an excuse for excursions to the

country as well as occupation in the house. Gentlemen patients ought to be taken often to public meetings, and both ladies and gentlemen to concerts, cricket-matches and the like. Divertissements of one kind or another should, in fact, frequently be arranged for, the doctor always accompanying or a deputy on whom thorough reliance may be placed.

The patient suffering from the "drink-crave" ought, indeed, by one means or another, to have his or her mind constantly employed. The diet at the home should be plain but good, with the introduction of as few highly seasoned dishes as possible.

Here I would take the opportunity to protest against the mistaken idea, too common in the minds of many members of the medical profession, that by the exhibition of such drugs as capsicum you can destroy the craving for alcohol, or at least keep it under. You may perhaps smother it for a while by repeated doses of the perchloride of iron, or one of the class of drugs to which capsicum belongs, or possibly by what was for a while so much vaunted—a particular sort of bark, or the more recently recommended strychnine "cure;" but my experience leads me to the conclusion (supported by the testimony of the patients themselves) that you are by this treatment only substituting one enslavement for another. The same remark applies to some extent to aërated beverages. Without absolutely interdicting them I recommend my patients to do without them, to drink plain filtered water at their dinner and take plenty of milk with either tea or coffee. It should be drilled into the minds of drink-cravers that the addition of a little lime water will make milk digestible by even the most delicate stomach. The regular meals in a Home for Inebriates ought to be four in number, besides afternoon tea, the latter being invariably very weak. Dinner should be early in the afternoon. Supper ought to be a light meal and in the case, at all events, of resent admissions ought frequently to be composed principally of well boiled oatmeal porridge—which makes an excellent "night-cap." The drink-craver should be induced to take cocoa in preference to either tea or coffee, to avoid almost entirely condiments (cayenne pepper and the like) with his food at dinner; and if he suffers—as most inebriates do—from pain in the stomach after food, to take large draughts of very hot water twice or three times a day. Smoking should

be reduced greatly if it cannot be entirely given up. A walk of about a mile before retiring for the night is often found most beneficial for those who suffer from sleeplessness.

In order to carry out, under his own eye, such details of treatment as I have indicated, the physician who thinks he has an aptitude for dealing with inebriates ought to give up all general practice and devote himself to not more than five or six resident patients. The domestic family feeling is destroyed if the number of "guests" exceeds six. If he has a healthy energetic wife who is also a good pedestrian he may undertake this number, provided two out of the six are ladies. Even so the labor for both the physician and his wife is enormous; the strain upon the physical and mental energies is constant and exhaustive. No money remuneration can repay them for their toil. They must be content with the reward of a good conscience. The men who seem to me best fitted for carrying on such work successfully from the physician's point of view are retired naval or military surgeons whose pension enables them to keep a roof over their heads till they have established a reputation for dealing *honestly* with the ladies and gentlemen who put themselves under their care. I say "honestly," for I do not consider any man can possibly do justice to drink-cravers resident in his family if he has constantly to be separated from them while attending at the houses of patients whom he has to visit in the ordinary course of general practice. The story has been so often told me by men who have had experience of such "playing at treatment" that I am convinced that many inebriates *prefer* to go to such houses, because they can do what I was told by a stockbroker (who was under my care, but left me because I was too strict) —that he did frequently. He used to go out with the doctor in his stanhope on his country rounds; he soon found out the topography of the district and how long the doctor (who was to be his shield forsooth from temptation!) was likely to be in certain patients' houses. It was a very easy matter, as he had plenty of money, to induce the coachman to take him to a certain place on the road where he might gather ferns (it was in Devonshire). The coachman used to allow his master's patient to get out of the stanhope at a gap in the hedge near the fern-bank, and then he would walk the horse up and down while waiting for the enthusiastic botanist. Unfortunately

there arose very frequently a cloud—it was evidently "a cloud with a silver lining"—between that coachman and the gap (a little further down the road) from which a few minutes' run could easily take the stockbroker to the way-side inn. It was a matter of only a few more minutes to run back to where he had got out of the stanhope. This little manœuvre was gone through just as often as was necessary to keep the pocket flask pretty well supplied for the stockbroker's "night-cap."

One of the greatest difficulties in dealing with inebriates of the upper classes arises from this silver-lined cloud. I try to induce those who come to me to give to a brother or the family lawyer—by no means to the wife or husband (as the case may be) "power of attorney" over all their money while with me. Even this, however, does not always suffice. I had a county magistrate once in my house who used to write to his own tenants and get money from them with which he tried to bribe my servants. The risks connected with bribery ought to be reduced to a minimum. If a patient attempts to bribe a servant of mine and if the latter informs me immediately and the patient confesses, I double the amount offered, give this to the servant and charge the added sum in the patient's next bill.

One of the great objections in my mind to *large* establishments and homes under the Act is the necessity to have a large staff of servants. Every hireling almost is open to a bribe, and the fewer you have, consistent with keeping the house comfortable, the fewer are the difficulties you have to contend against in reference to clandestine introduction of alcoholic drinks. If a "Home" under the Inebriates Act is to pay, it must be capable of accommodating at least a dozen. Now I have said already that I consider five, or at most six, inebriates—all being of the cultured classes—are as many as any married physician and his wife, both working hard, can look after properly. Moreover, small homes have this great advantage, that they are not as widely known as the larger establishments, and the high-class drink-craver is not so averse to entering them.

But for inebriates of the cultured class there is to my mind, as a physician, a still greater objection to Homes under the Act. The essence of good treatment lies in your being able to get your patient to enter *con amore* into your plans, in induc-

ing him to treat you, as it were, as his partner in a scheme he has laid down for his own benefit. There should be the most thorough confidence between both. Suppose, for argument's sake, you have a patient with you under the Act; suppose that one day he sees his chance of evading you while in the town and goes off and gets drink. You pursue him, and after a wearying search you find him at the bar of an hotel sipping whiskey punch. You invite him to accompany you home. He refuses. You say, "Well! you really must come!" Finally you put into force the powers with which you are armed under the Act. You compel your patient to return under your roof. What pray are the relations thenceforward existing between you both? You are his jailer, not his confidential friend. He completes his time in your house and leaves you with the same feelings that a thief entertains for the governor of the prison in which he has been incarcerated. It would be a different matter if the length of time for which patients as a rule submitted themselves to the discipline of a Home under the Act were sufficiently long (say eighteen months) to allow the disagreeable reminiscences of this capture and forcible bringing back to the "Home" to have passed away. A physician ought to try and secure the coöperation of his patient *entirely*. When a man becomes the jailer, he ceases (in the mind of the inebriate) to be his physician.

One word, in conclusion, as to the importance of the physician who undertakes the difficult task of systematically treating the drink-crave not only being himself a total abstainer—indeed he ought to be a member of the Medical Temperance Association—but also insisting upon every member of his household being a pledged teetotaller.

Much more has been effected by me through the influence of example than by any precepts or admonitions. In fact I seldom allude to the subject except it be introduced by the sufferer himself or herself. My patients see what an active, vigorous, enjoyable life I lead, how lightly the burden of well-nigh fifty years is borne by me, albeit in the earlier part of my medical career my constitution was put to a severe strain by a fever contracted in the West Indies. They see that hard work and brightness and activity, and thorough enjoyment of life can be sustained without the so-called enlivening stimulus and "support" of wine or other alcoholic beverage. I believe

that the lesson the patients learn in this way is better than any others that can be taught.

Before I sit down I should like to summarize some of the conclusions at which I have arrived as a result of constant clinical study during the last twelve years:—

(1) Drunkenness and inebriety ought not to be confounded.

(2) Inebriety is a lesion of the brain which has gone so far as to affect the will-power.

(3) Successful treatment based on this pathological dictum must include the absolute cessation of alcoholic drinking.

(4) There is no danger in the sudden and complete withdrawal of alcohol if the case—no matter how severe—be in the hands of a skilful physician able to personally direct the hourly treatment from the first.

(5) The physician undertaking the charge of such cases ought to be a total abstainer as well as every one living under his roof, so that moral treatment by example may supplement therapeutic remedies.

(6) Permanent recovery need not be hoped for unless both lines of treatment be pursued, systematically, during an uninterrupted period of twelve months in a "Home" from which every beverage containing the smallest quantity of alcohol is absolutely excluded. The first four months barely suffice for the getting rid of the stomach and other troubles which are the result of the alcoholic poison; at the end of the second period of four months the patient begins to feel less the want of alcohol; by the end of the third period he has begun perhaps to understand that life may be enjoyed, and vigorous health secured without stimulants.

(7) So-called "cures" effected by bark, strychnine, iron, and other drugs have not proved permanent.

(8) The permanence of a cure depends greatly on the after-treatment pursued subsequently to the patient leaving the "Home." The family of the inebriate, or the household of which he or she is to form a part, ought all to become total abstainers, no alcohol being allowed under any circumstances into the house except as a drug prescribed by a medical man and dispensed in a medicine bottle.

MANUAL

OF

HYPODERMIC MEDICATION

BY

DRS. BOURNEVILLE AND BRICON, OF PARIS

TRANSLATED FROM THE SECOND EDITION, WITH ADDITIONS

BY

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REARRANGED AND REVISED

FOR THE USE OF AMERICAN PRACTITIONERS

MANUAL OF

HYPODERMIC MEDICATION.

PREFACE TO THE SECOND EDITION.

THE medical public accorded so favorable a reception to the "Manual of Subcutaneous Injections" that the first edition was exhausted in less than two years. This success imposed on us the obligation of bringing the greatest care to bear on the revision of our work and bringing it, as far as possible, up to date.

To the already long list of remedies employed by the hypodermic method which appeared in the first edition we have had to add a certain number which have been administered subcutaneously during the last two years. Such are—chrysarobin, osmic acid, agaricin, antipyrine, convallaria majalis, cocaine, cotoin, eucalyptol, ichthyol, kairine, nitroglycerin, paracotoin, paraldehyde, pereirine, permanganate of potassium, salicylate of sodium, and thalline.

Although we have consulted all the periodicals which we have been able to obtain, and the number of them is considerable, and although we have availed ourselves of the too rare communications that have been sent to us, we renew the appeal which we made on a previous occasion to our readers: viz., that they would point out to us any errors and omissions which they may observe in this new edition.

TRANSLATOR'S PREFACE.

THE "Manuel des Injections Sous-cutanées" of Drs. Bourneville and Bricon has achieved such notable success on the Continent, and, besides giving a great impulse to hypodermic medication, has done so much to advance the science of therapeutics generally, that no apology is, perhaps, required in introducing a translation of it to English practitioners. There

is not a superabundance of works in the English language on the subject of which this manual treats, for, with the exception of Dr. Bartholow's well-known and instructive treatise, "Manual of Hypodermatic Medication," the last edition of which was published in 1882, and Prof. Matthew Hay's admirable translation of Eulenburg's essay in Ziemssen's "Handbook of Therapeutics," nothing has been published in this country or America within recent years. The little work of Drs. Bourneville and Bricon possesses the advantages of being very complete and yet concise, of containing a large number of formulæ, of being well up to date, and, what seems to be a feature of no small importance, it points out the disadvantages which have accrued, or are apt to accrue, from the use of certain drugs by the hypodermic method.

It is with sincere pleasure that I take this opportunity of acknowledging the assistance which many kind friends have rendered me.

Drs. Bourneville and Bricon have taken a warm interest in the translation, and have helped me in every possible way. To Mr. Martindale I am indebted for valuable hints and also for permission to borrow formulæ from the "Extra Pharmacopœia." My colleague Dr. Whitlaw Scott has rendered valuable assistance in revising the translation and correcting proofs. My brother, Mr. R. K. Currie, has helped me to an extent which it is impossible for me to over-estimate, by converting the metric system to the English equivalents and by revising the sheets before they were sent to press.

Numerous authorities have been consulted in the work of translation which it is impossible to mention in detail, but it would be ungrateful on my part were I not to particularize Dr. Neale's invaluable "Digest" and his recently published "Appendix to the Digest," which have been consulted constantly and in which I have rarely, if ever, failed to discover the information sought for.

In the hope of enhancing the value of the Manual, I have added a therapeutic index based on those in Dr. Ringer's "Handbook of Therapeutics" and Dr. Lauder Brunton's recently published work "Pharmacology, Therapeutics, and Materia Medica," a table of antidotes and antagonisms, a posological table, and a general index. With these exceptions there is but little added to the work for which I am personally

responsible, but it is hoped that these few additions will not be deemed irrelevant. They have been inserted on the principle so nobly expressed by Goethe—

"Vor den Wissenden sich stellen
Sicher ist's in allen Fällen!
Wenn du lange dich gequälet
Weiss er gleich wo dir es fehlet;
Auch auf Beifall darfst du hoffen,
Den er weiss wo du's getroffen."

It will be observed that, as a rule, the formulæ in this translation are in quantities of 16, or multiples of 16 minims. In the French edition Drs. Bourneville and Bricon generally adopt the gramme (the capacity of a Pravaz syringe) as the standard. In the Introduction they say that a Pravaz syringe with a capacity of one gramme is equivalent to 20 drops; but the drop is both an inconvenient and uncertain quantity, varying widely for different fluids, and accordingly the following system has been adopted in the translation. According to the British Pharmacopœia (1885), 1 gramme = the weight of 1 cubic centimetre of water at 4° C. Now the cubic centimetre is equal to 15.432 grain measures fluid, or 16.975 minims; (or somewhat less than this value according to the U. S. Pharmacopœia of 1882); but it is obvious that 17 would be a very awkward figure to take as the equivalent of the capacity of the Pravaz syringe, there being no figure that will divide 17 without a remainder, and had this figure been adopted there would have been a risk of falling into error where ½, ¼, or ⅛ of a cubic centimetre was ordered. By adopting 16, however, as the standard, these fractions can be used with absolute correctness, and an ordinary hypodermic syringe can be employed in using the formulæ in the manual.

Where the dose of a solution is stated as one syringeful, it is to be understood that 16 minims is the quantity meant.

NOTE BY THE AMERICAN PUBLISHERS.

In preparing an American edition of this work, it was found necessary to make changes both in the text of the original author as translated, and also in the additions made by the English translator. The changes consist mostly in a rearrangmeent of the articles in proper alphabetical order, the introduction of a more consistent nomenclature in har-

mony with present views, the revision of data relating to the derivation, constitution, and physical properties (solubilities, etc.) of a number of chemicals, and the addition of practical notes, not from a medical, but from a chemical and pharmaceutical standpoint. The American publishers are under great obligations to Dr. Charles Rice for kindly arranging this matter, and the readers of the present issue of the work will enjoy the advantage which his careful revision will afford. It would have incumbered the text with too many notes in brackets to have indicated all the changes made, but many notes have been separately added, and signed with the initial "R." A number of notes, and references to literature not readily accessible to readers in this country, have been omitted.

HISTORY.

THE first attempts at hypodermic injections appear to have been made by Dr. Rynd ("Dublin Medical Press," 12th March, 1845); but it is to Dr. A. Wood (1855) that we owe the popularization of this method. Dr. Sieveking of London has claimed priority for M. Kurzak of Vienna ("Lancet," 1861, Vol. I., p. 309). According to Dr. Bartholow, Dr. J. Taylor, in a communication to the "New York Medical Gazette," asserted that he had used the hypodermic method from 1839, simultaneously with Dr. Washington; this proceeding had been suggested to them by Lafargue's plan of inoculation. They employed Anel's syringe. Langenbeck had also, before Rynd, employed the hypodermic method, but he abandoned it afterward for the method by inoculation. In England, we may mention, among the first experimenters, Messrs. Wright (whose observations were published in Wood's memoir), Oliver, Bonnar, B. Bell, Charles Hunter (who gave the name *hypodermic* to the subcutaneous method), Fuller, Cadwell, Cowan, Anstie, etc.

We may recall the fact that the injection of remedies into the veins was commonly practised in the 17th century; that the endermic method (Lambert) and the method of inoculation (Lafargue) had numerous partisans in the first half of the present century, to say nothing of the plan of dry injections of M. Bruns (1869). (See Eulenburg, "Percutane, intrac., subc., Arznei-Application," 1880, pp. 4, 28, 30, 34.) Valleix, who had used the endermic method in cases of neuralgia, had also attempted the introduction subcutaneously of remedies by

means of acupuncture needles. We may add that physiologists had for a long time practised the hypodermic method (Gaspard, Magendie).

The hypodermic method was introduced into France by Béhier and Courty; they made use of the syringe which Pravaz had devised for coagulating injections of perchloride of iron. Their example was soon followed by numerous authors:—Hérard, Vella, Vulpian, Follin, Gintrac, Benoit, Fournier, Dupuy, Dolbeau, Gosselin, Becquerel, Bourdon, etc.

In Germany, Drs. Bertrand (of Schlangenbad) and Genth (1857), A. V. Franque, Eulenburg, Lebert, Erlenmeyer, Semeleder, Oppolzer, Zülzer, Südeckum, von Graefe, Scholz, Hermann, Lorent, Nussbaum, Scanzoni, etc., were the first to practise subcutaneous injections.

In Italy, Gherini of Milan (1861), then B. Guala of Brescia, first employed hypodermic injections. We may quote, moreover, in the same country, the names of Timermans of Turin, Lesi, Porta, Scarenzio, Petrini, Monteverdi, Schivardi, etc.

Dr. Ruppaner was the first to introduce the hypodermic method into the United States (1860); Dr. Bartholow, however, attributes the priority to Dr. Fordyce Barker of New York (1856), then to Dr. Elliot (1857).

We think it will be useful to append here a list of the principal treatises and essays of interest which discuss the hypodermic method in its general aspect.

SÜDECKUM—"Subcutane Injectionen medicamentöser Flüssigkeiten." Inaugural-Abhandlung, Jena, 1863.

GAUDRY—"Injections sous-cutanées." Thèse de Paris, 1863.

BOIS—"De la méthode des injections sous-cutanées." Paris, 1864.

ERLENMEYER—"Die subcutanen Injectionen der Arzneimittel," 1st edit., 1864.

EULENBURG—"Die hypodermatische Injection der Arzneimittel," 1st edit., 1865.

HUNTER (Charles)—"On speedy relief of pain and other nervous affections by means of the hypodermic method." London, 1865.

RUPPANER—"Hypodermic injections in the treatment of neuralgia, rheumatism, gout, and other diseases." Boston, 1865.

LORENT—"Die hypodermatischen Injectionen nach klinischen Erfahrungen." Leipzig, 1865.

JOUSSET (de Bellesme)—"De la méthode hypodermique et de la pratique des injections sous-cutanées." Paris, 1865.

GALLOT—"De la méthode hypodermique en général et des injections sous-cutanées de sulfate d'atropine en particulier." Thèse de Paris, 1866.

SCHIVARDI—"La medicazione ipodermica." Milan, 1868.

DENIS (A.)—"Considérations et expériences sur la méthode hypodermique." Thèse, Strasbourg, 1868.

LESI—"La siringa di Pravaz e le injezione ipodermiche," 1868.

MICHALSLI—"De la méthode hypodermique." Thèse, Paris, 1868.

BARTHOLOW—"Manual of hypodermic medication." Philadelphia, 1st edit., 1870; 4th edit., 1882.

SALVADOR BADIA—"La curacion de la syphilis por las inyecciones hypodérmicas de bicloruro hydrargyrico segun los métodos de los profesores Lewin (de Berlin) y Letamendi (de Barcelona), con un appendice sobre la medicacion hipodermica en general." Barcelona, 1873.

LUTON—"Etudes de thérapeutique générale et spéciale. Injections hypodermiques," p. 193. Paris, 1882.

EULENBURG—"Percutane, intracutane und subcutane Arznei-Application," in "Handbuch der allgemeinen Therapie," von H. v. Ziemssen. Leipzig, 1880, B. I., III. Theil.

BERNATZIK—"Hypodermatische Methode" in "Real-Encyclopädie der gesammten Heilkunde." B. VII., 1881, pp. 21 *et seq.*

COCHET—"Contributions à l'étude des injections hypodermiques." Thèse de Paris, 1883.

FREDERICO GOMEZ DE LA MATA—"Manual de inyecciones hipodermicas." Madrid. This manual is largely composed of articles by us which appeared in the "Progrès médical" in 1883.

LUTON—"Transfusions hypodermiques" ("Archives générales de médecine," December, 1884).

SUBCUTANEOUS ABSORPTION.

All authors are agreed in admitting absorption by the cellular tissue; it is constant, regular, and effected with great rapidity, less rapidly, however, than absorption by the respiratory mucous membrane or by the veins (intravenous in-

jection). The acceleration or retardation of absorption may be brought about experimentally by section or galvanization of the great sympathetic (see on this subject, Claude Bernard, "Leçons de Pathologie exp.," 1872, pp. 285–287). Apart from the influence of the nervous system on the rapidity of absorption, it is to be observed that all substances are not absorbed at the same rate (experiment of Bernard with ferro-cyanide of potassium and lactate of iron). Moreover, the rate of absorption of the same substance varies in direct proportion to its solubility.

Such is the general rule; but there are certain circumstances in which absorption is modified. It is thus that some remedies, introduced under the skin, may, by their local action, induce inflammatory troubles which disturb the therapeutic and physiological results (a large number of substances coagulate with albumen), or even prevent these results by opposing absorption. This last result is sometimes sought for, when, for example, in malignant pustule we endeavor to limit the original situation of the pus by the aid of peripheral injections of iodine.

Absorption by the cellular tissue being recognized as incontestable, it remains to be shown in what manner it is effected. Here we encounter a great variety of opinions; absorption by the veins, capillaries, lymphatics, by diffusion, etc. In the present state of our knowledge we believe there is no doubt that absorption in the subcutaneous cellular tissue is chiefly effected by means of the lymphatic system, and in support of this opinion we can appeal to no stronger testimony than that of M. Ranvier.[1]

"The fibres and membranes of which the connective tissue is composed, constitute," he says, "a system continuous of itself in all parts of the organism, furrowing and partitioning, in various ways, a vast reservoir, all the chambers of which communicate with one another. The great serous cavities form just as much a part of this system as do the interstices of the loose connective tissue. This reservoir belongs to the lymphatic system, and in all its parts it contains lymph elements. The direct communication of the large serous cavities with the lymphatic vessels is a fact conclusively proved by science; the origin of the lymphatic vessels in the meshes of the loose connective tissue is still an open question, but, *à pro-*

pos of the lymphatic system, we may detail a series of facts which tend to prove that they really arise in the interstices of this tissue. . . ."[2]

Regarded from the point of view of the mere administration of drugs, subcutaneous injection, when the substance injected does not excite local troubles, offers in addition to the benefit of rapid absorption, this great advantage that the medicine is absorbed in its entirety without any modification; all which conditions place the hypodermic method far above every other mode of administering remedies.

The experiments of Messrs. Eulenberg and A. Denis show that *the site* at which the injection is made exercises an important effect on the rate of absorption: moreover, the effects produced by similar doses vary with the region injected. (Lambert, as far back as 1810, pointed out that absorption was more readily effected on the inner surfaces of the thighs and legs, arm, forearm, and anterior surface of the chest.) These gentlemen have made some interesting observations which are summarized in the following table:—

1. Temples and cheeks.
2. Epigastrium.
3. Anterior portion of thorax.
4. Supra- and infra-clavicular regions.
5. Inner aspect of arm and thigh.
6. Nape of the neck.
7. External aspect of thigh and arm.
8. Forearm.
9. Leg.
10. Foot.
11. Back. (In the last two regions the effect is often nil.)

Despite the authority which necessarily attaches to the names of the authors whom we have quoted, we think it right to accept this classification with a certain amount of reserve.

Solutions.

The details which we give under the head of each drug rendering it superfluous for us to enter here at great length into the question of solutions, we will therefore confine ourselves to a few general remarks. It is often desirable to make use of fresh and even of specially prepared solutions; distilled water

is the best vehicle, provided it is not a question of alterative injections. Solutions in equal proportions of glycerin and water are well borne by the tissues, but other solvents or vehicles can also be employed without inconvenient results (so cherry-laurel water, ether, alcohol, oils, etc.).

We may add that it is desirable, when possible, to inject fluids at a temperature of about 37° (98.5° F.); and that it is often advantageous to add to the solution a few drops of a solution of carbolic or salicylic acid [or to use chloroform water in the preparation of the solution], for its better preservation.

The solutions should be as far as possible neutral; it would, however, be a mistake to suppose that this is absolutely indispensable. In fact, we are often obliged to have recourse to *acid solutions*, which are as a rule more or less painful. Here we must observe that the pain is not generally proportionate to the acidity of the injection; thus, solutions of sulphate of quinine in tartaric acid are more painful than solutions made with sulphuric acid, although the acidity in the latter case is much more intense.

In other instances, the irritating quality of neutral solutions depends upon the substance dissolved, as we shall see when we speak of local irritations. Hence it follows that the mere fact of a solution being neutral is not sufficient to insure its being free from irritating qualities.

The degree of concentration of the solutions remains to be considered. In regard to substances of very active properties this is of minor importance; but for most substances we are precluded from employing the hypodermic method, either because the solubility of the drug to be used is too slight to permit of its being injected in sufficient quantity without serious inconvenience, or because when the remedy is obtained in the necessary degree of concentration it acquires irritating properties.

In some countries, especially in England, use is made of hypodermic injections extemporized from solutions of gelatin discs containing measured doses of the required drug; these discs are dissolved in a few drops of distilled water.

Eulenburg and other authorities discountenance the practice of filtering thick solutions, a custom which, owing to the nature of the medicament, may diminish the activity of the

solution. M. Bourdon is equally opposed to filtering old solutions which have become thick or muddy by the development of cryptogamic filaments: these solutions have in fact to a large extent lost their medicinal properties and should be prepared afresh.

Percentage solutions are most convenient, and the following may be taken as the type or unity.

Salt, ...	1
Distilled water, ...	99

If we take one gramme (15½ English grains) of water as equivalent to twenty drops, it follows that a syringe with a capacity of one gramme would contain a centigramme (about one-seventh of a grain) of the active principle, and one drop weighing five centigrammes would contain half a milligramme (a milligramme is equivalent to about $\frac{1}{64}$ of a grain). But the drop is of all forms of dosage the most inaccurate, the drops given by different instruments being never quite identical, although it is in very common use: it would therefore be preferable to reckon by weight. The various tables published by authors, among others those of Messrs. Réveil, Bouchardat, Yvon, show remarkable variations even for the same fluid.

We give below the table published in the essay of M. Surun. This table, which we have thought it better to abridge somewhat, shows the solubility of a certain number of substances in one hundred parts of glycerin. [This table is quoted by but few authors. Other tables of solubility can easily be referred to in other works, as that of M. Fonssagrives, etc.]

Bromine, ...	In all proportions.
Iodine, ...	1.90
Bromide of Potassium, . .	25
Iodide of Potassium, . . .	40
" Zinc, ...	40
" Iron, ...	In all proportions.
Sulphide of Sodium, . . .	" "
Bisulphide of Potassium, . .	25
Cyanide of Potassium, . .	32
" Mercury, . . .	27
Chloride of Ammonium, . .	20
" Sodium, . . .	20

Chloride of Barium,	10
" Antimony,	In all proportions.
Perchloride of Iron,	" "
Bichloride of Mercury,	1.50
Chlorate of Potassium,	3.50
Hypochlorite of Sodium,	In all proportions.
" Potassium,	" "
Arsenious Acid,	20
Arsenic "	20
Arseniate of Sodium,	50
" Potassium,	50
Sulphuric Acid,	In all proportions.
Nitric Acid,	" "
Phosphoric Acid,	" "
Hydrochloric Acid,	" "
Chromic Acid,	Decomposes.
Acetic Acid,	In all proportions.
Tartaric Acid,	" "
Citric Acid,	" "
Oxalic Acid,	15
Boric Acid,	10
Lactic Acid,	In all proportions.
Benzoic Acid,	10
Ammonia,	In all proportions.
Carbonate of Sodium,	98
Bicarbonate of Sodium,	8
Carbonate of Ammonium,	20
Urea,	50
Borate of Sodium,	60
Alum,	40
Sulphate of Iron,	25
" Zinc,	35
" Copper,	30
Nitrate of Silver,	In all proportions.
Bichromate of Potassium,	Decomposes.
Permanganate of Potassium,	"
Acetate of Lead,	20
" Copper,	10
Tartar emetic,	5.50
Tartrate of Iron and Potassium,	8
Lactate of Iron,	16

Tannin,	50
Quinine,	0.50
Cinchonine,	0.50
Sulphate of Quinine,	2.75
" Cinchonine,	6.70
Codeine,	In all proportions.
Morphine,	0.45
Hydrochlorate of Morphine,	20
Atropine,	3
Sulphate of Atropine,	33
Strychnine,	0.25
Sulphate of Strychnine,	22.50
Brucine,	2.25
Veratrine,	1

Instruments and Operative Procedure.

I. Instruments.

The first physicians who had recourse to hypodermic medication made use of a variety of syringes, among which we may quote:—1st. Fergusson's syringe, the needle of which, being of too large calibre, in penetrating the tissues tears them, and occasions thereby severe pain; this syringe, which

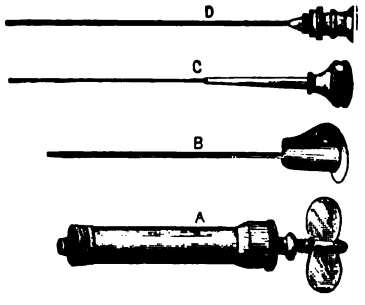

Fig. 1.

as a rule is badly graduated, was chiefly employed by Wood. 2d. Pravaz's syringe (Fig. 1) the piston of which has a screw action, each half turn of the screw expelling from the extremity of the canula one drop of solution. These two syringes, which are not used now, were invented by their designers for the use of coagulating injections of iron perchloride.

Pravaz's syringe as modified by Béhier (Fig. 2) is a trocar syringe; it has, apart from its small capacity, this inconvenience that it necessitates a prolonged operative procedure; moreover, the quantity of fluid expelled by each semi-revolu-

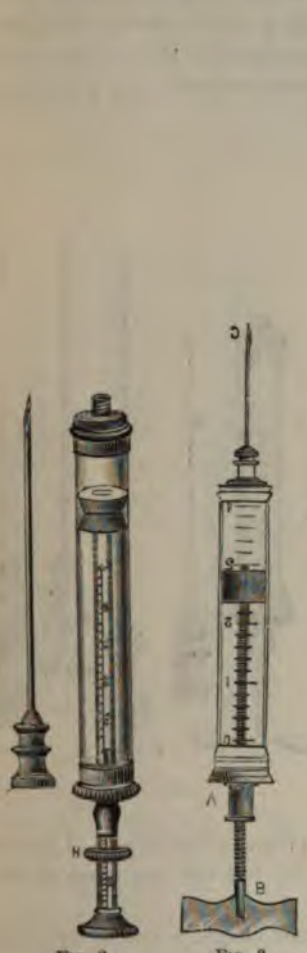

Fig. 2.

Fig. 3.

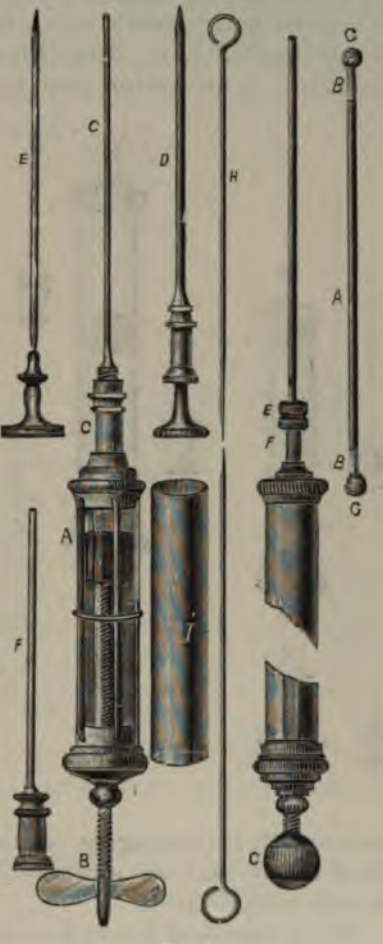

Fig. 4.

tion of the piston is uncertain and varies with the syringe. Béhier, however, has himself discontinued its use. The metal cylinder of Pravaz's syringe was replaced by one of glass.

The decimal syringe of M. Mathieu has a capacity of four

grammes; the barrel of the syringe is of glass and has four circular divisions, each corresponding to one gramme (Fig. 3).

M. Charrière abandoned the trocar of the Pravaz-Béhier syringe, and replaced it by a perforated needle, one of its extremities having a sharp cutting point, and furnished at the other end with a screw which fits on to that which terminates the syringe (Fig. 4). Since the introduction of this instrument the screw of the piston stem has been replaced by a stem fur-

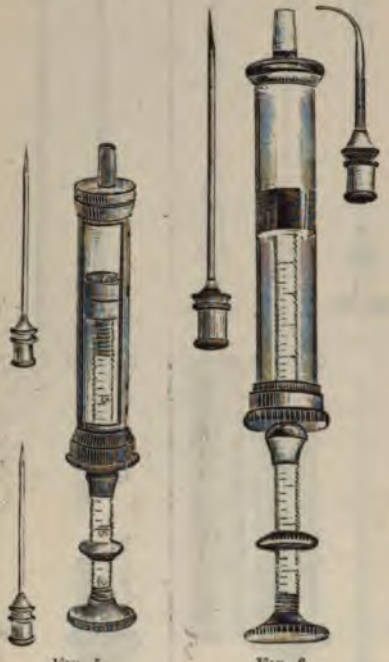

Fig. 5.

Fig. 6.

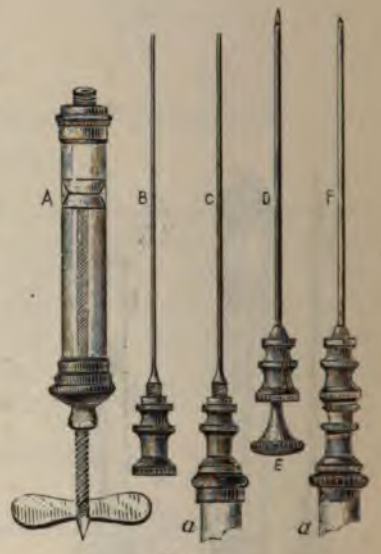

Fig. 7.

nished with a running screw-stop (Fig. 5, Collin's). The barrel of the syringe has a calibre graduated for one drop of fluid to each millimetre.

The syringes of Leiter and of Lüer (Figs. 6 and 7) are glass syringes with a large flat piston stem marked off into divisions which indicate, when it is drawn out, the quantity of fluid contained beneath. The extremity carries a hollow needle with a harpoon-shaped end. M. Lüer's syringe is the one most commonly in use in Germany and France. [M. Lüer appears to have been the first to have replaced the screw

piston by the graduated piston with the running screw-stop, and the screw nozzle by a smooth surfaced nozzle.]

A syringe which is in very general use, and which is still commonly known as Pravaz's, is composed of a crystal barrel, strengthened by two vertical stems. These stems are united by two nozzles which close the instrument above and below: the inferior nozzle is in the form of a canula, intended to be adapted to the canula of the needle; the upper nozzle is pierced by a hole through which the stem of the piston passes: this stem is marked with twenty divisions, each of which corre-

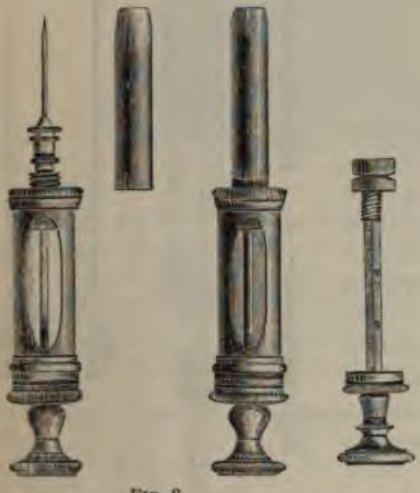

Fig. 8.

Fig. 9.

sponds to a drop of fluid. The capacity of the syringe is one cubic centimetre or twenty drops.

Sometimes the fluid is expelled by rotation of the piston, for which purpose the stem is furnished with a screw; at others, on the contrary, the piston is worked by pressure, in a straight line, with the finger, on a knob by which the piston is terminated. To the syringe is fitted a canula ending in a needle of strong steel and with a sloping cutting edge at its extremity.

We need not do more than mention the syringes of Travoy, Danet, Bourguignon, de Graefe, C. Hunter, Liégeois, Coxeter, Young, Bartholow, Gemrig, Ward, Cousin, Buzzard, Cutter,

Dop; the syringe of Arsonval (made by Aubry), having the needle perforated at different levels, for submucous injection; the vulcanite syringes of Tiemann, Mules, Galante (Figs. 8 and 9) [the glass cylinder is movable, the needle is protected by a cylindrical sheath, perforated at its extremity; the instrument may be safely carried in the pocket], of Maisonneuve (Fig. 10), of Krause; lastly, the syringes of large capacity, such as the infusor of Hueter, with a capacity of 14 grammes, and that of M. Dujardin-Beaumetz, with a capacity of five grammes. Dr. Jennings recommends the use of an instrument with a graduated barrel, furnished with a pipette.

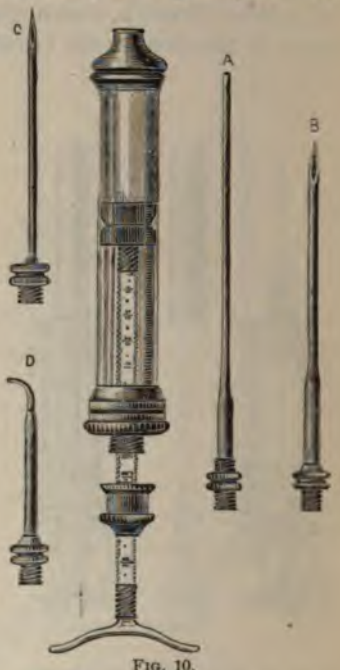

Fig. 10.

Some agents act on the syringes and corrode them. Such are the salts of mercury which attack after a time even gold needles. Hence the advice of M. Neumann not only to rinse with water after having used the needle, but to blow air through it by means of an india-rubber ball.

In conclusion we may mention the complex cases containing, besides the ordinary Pravaz syringe, either medicines, or other needles for use in deep injections. Such is that of Messrs. Burroughs and Wellcome who have devised a portable hypodermic case. This contains (Fig. 11), besides the syringe, a certain number of tubes inclosing Wyeth's hypodermic tablets; these tablets, which we regret are not generally used in France, are composed of an alkaloid combined with a sufficient quantity of sulphate of sodium to obtain the necessary consistence. One of these is dissolved, when required, in a few drops of distilled water. We can see how, by this means, the injection can be more readily effected, to say nothing of the advantages which accrue to the practitioner from always having a collection of the principal alkaloids at his command.

The syringe of M. Delore of Lyons (Fig. 12), made by M. Mathieu, has a capacity of 4 grammes (about 64 minims); the piston stem has 40 divisions. To this syringe can be applied, (1) a needle like those of the ordinary Pravaz syringes; (2)

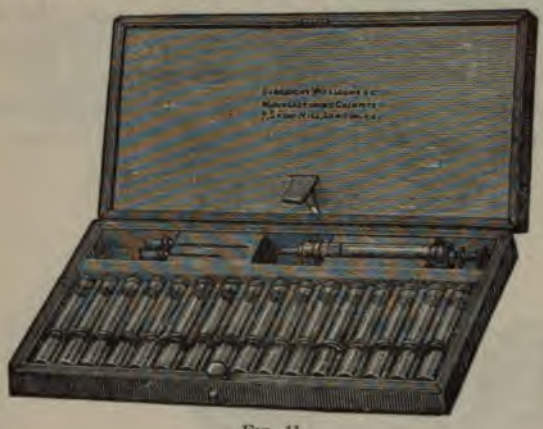

Fig. 11.

two metal canulæ with a length of 13 centimetres; one has a needle perforated in the usual way, the other is made so as to carry a gum elastic sound, and has two lateral perforations. The syringe is, moreover, furnished with two wings which impart steadiness to the instrument during the injection. M. Delore's instrument is made of silver to prevent any chemical

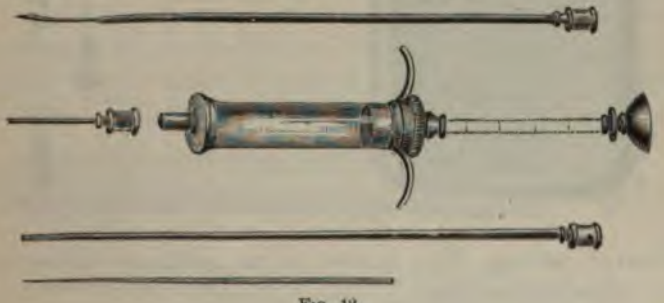

Fig. 12.

action upon it by the solutions. It can be employed like the ordinary Pravaz syringe to practise interstitial injections into the uterine tissue, or it can be used with the canula and gum elastic sound to make ordinary intra-uterine injections.

A very convenient combination of hypodermic syringe and

accessories is that shown in Fig. 13, all the parts being securely held in compartments within a metallic case having either a hinged or a removable lid.

Brown's pocket case hypodermic syringe is of hard rubber, and of about the size of a stylographic pen. At the lower end is a receptacle capable of containing about a dozen compressed pellets for making hypodermic solutions.

Another convenient pocket case syringe is Stimson's, Fig. 14. The point including the wire cleaner fits into a hollow

Fig. 13.

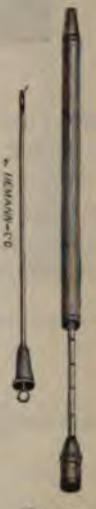

Fig. 14.

graduated piston. The barrel is an ordinary silver tube, about three inches long.

Recently some makers have constructed syringes which can be adapted to a little vial containing the solutions, thus allowing the syringe to be charged without exposing the solution to the air (Figs. 15 and 16). Fig. 17 shows the models of Messrs. Mathieu and Collin.

[Messrs. Ferris and Co., Bristol, make a small syringe which

was suggested by Dr. Sheen of Cardiff. It is chiefly intended for morphine injections, has a capacity of five minims, and is designed so that it may be attached to the watch chain, to which it forms an elegant appendage (Fig. 18).

Fig. 15.

The accompanying illustration (Fig. 19) represents a hypodermic pocket case designed by Messrs. Burroughs and Wellcome. The case instead of being pasted is sewn, and is thus

Fig. 16.

rendered more proof against the effects of heat and damp. It contains a small syringe of solid silver, which fits into a silver case provided with a cap. This cap answers two purposes:—

Fig. 17.

it prevents drying and consequent shrinking of the piston-packing, an inconvenience which is only too common with syringes that are laid aside for any time and it is used as a mortar in which the hypodermic tabloids are powdered. In

addition to the syringe, the case is provided with several tubes of tabloids containing precise doses of the alkaloids in most

FIG. 18.

general use, such as morphine, atropine, ergotinine, apomorphine, etc. A writing tablet is also provided. The whole case

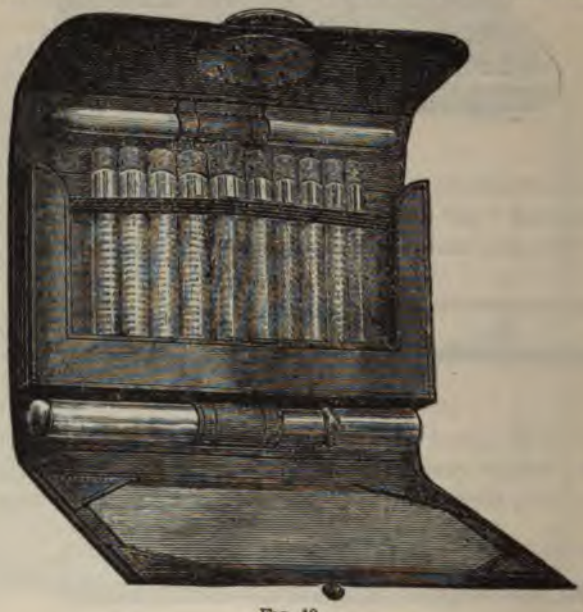

FIG. 19.

is in such small compass that it can be carried in the pocket without inconvenience.—*Trans.*]

II. Operative Procedure.

Before using a needle it is necessary to ascertain its perfect cleanliness and to see that it is in working order. The solution being in readiness, the instrument must be filled, care

being taken to exclude air, and the needle should be anointed with carbolized oil. There are two methods of introducing the needle; some recommend that it should be first introduced by itself and that the syringe should then be fitted on to it; others, on the contrary, and this is the usual practice, adjust the needle to the instrument before insertion.

Some assert that certain accidents which may occur are guarded against by the first method of procedure; that if, for example, the needle has penetrated a vein the operator is warned by the escape of blood through the needle or by its unnatural mobility. We do not think that these accidents need be feared; and in any case the advantages of this method do not compensate for its disadvantages, such as the longer time it takes, the greater risk of tearing the cellular tissue, etc. Those who adopt the other plan push in the needle either slowly or suddenly.

To introduce the needle into the subcutaneous cellular tissue, the operator seizes a fold of the skin between the thumb and index finger of the left hand, so as to put it on the stretch, then he introduces the needle at the base of the fold at an angle of about 45°. This done, he lets go the fold of skin and steadies the canula of the instrument between the thumb and index finger of the left hand to guard against tearing of the tissues by any lateral movement, and with the right hand he expels the fluid by a rotating movement of the piston, or by pressing gently on the crown by which the piston is terminated externally.

If it is desired to inject the full contents of the syringe it must be done gradually, and it is also desirable to pause a few seconds at the fifth, tenth, and fifteenth divisions. The needle is withdrawn in the same direction in which it is inserted. It is necessary to apply the left index finger to the point of puncture, to prevent the escape of the fluid or its soaking into the skin.

Some authors, among others M. Le Moaligou, to prevent the fluid spreading to the deep surface of the skin where the vacuum is produced along the track of the needle, when it is quickly withdrawn, advise that slight pressure should be made for a few seconds above or below the point of puncture according to the direction in which the injection has been made—from below upward or from above downward.

It only remains to cleanse and if necessary to disinfect the instrument. To effect this it is always desirable to expel the last drops of fluid from the needle, and not to lay it aside without inserting the silver wire, or, better still, a pig's or boar's bristle.

If it is a matter of consequence to make use of well proportioned solutions, it is no less so to ascertain exactly the capacity of the syringe which is used. It must not be forgotten that, in spite of every care on the part of the instrument maker, syringes often differ from one another in their calibre.

To ascertain the capacity of a syringe, it should be weighed, first full of water and then empty; it should afterward be ascertained by successive weighings that it is of equal calibre throughout (we ascertain thus the quantity in weight of fluid which is expelled by a given movement of the piston), the syringe containing a definite quantity of water for a certain number of rotations of the piston or of degrees on the barrel.

The syringes which are in most general use contain as a rule one gramme of distilled water (twenty drops).

Local Accidents.—Like all other therapeutic measures, the hypodermic is not without its inconveniences. They arise sometimes from the drug itself or its excipient, at others they are due to the inexperience or awkwardness of the operator.

The puncture may of itself be a source of *pain*, which is always slight and transient if the point of the canula is sufficiently sharp and small. Generally this accident is due to the operator, either because the point of the instrument has not completely penetrated the skin, or because the fluid has been injected too suddenly, or again, because the instrument, badly inserted, has torn the fibres of the connective tissue, or has transfixed a nerve. *Want of cleanliness* of the canula, perhaps even of the operator, may give rise to serious troubles.

Slight *hemorrhage*, sometimes caused by the puncture, is of little consequence and may be disregarded. May the same thing be said of the introduction of the canula and subsequent injection into a vessel? As a general rule it may, if the fluid is free from turbidity and non-irritating, and if the dose of medicine injected cannot be productive of poisonous results; for we know that in such a case absorption cannot keep pace with elimination.

Injection of air as a rule is of little consequence. It is

quite otherwise, however, when fluid is *injected into the substance of the skin.* In this case, besides the pain and the resistance which is offered to the passage of the piston down the syringe, we observe an elevation of the epidermis, closely resembling urticaria spots, and leaving behind, sometimes, a *superficial scar.*

A frequent accident, of less importance than the rest, is *ecchymosis.* This casualty is frequently due to the too great force with which the injection is made, but even when the utmost precaution is used, ecchymosis may be produced in a subject whose skin is delicate.

Too large a quantity of fluid injected at one point may also be the cause of pain, ecchymoses, scars, abscess, etc.

Some advise that the needle should be introduced deeply into the cellular tissue and then slightly withdrawn to make a channel for the fluid, but this proceeding is of doubtful utility. It has also been advised to expel the injection at the level of the superficial fascia (between the subcutaneous tissue and the muscular aponeurosis), the theory being that the fluid injected in this way diffuses itself better, that the fascia is not so sensitive, and that, by adopting this plan, there is little danger of the fluid escaping by the puncture. The advice is good, but it is difficult to carry it into practice.

Another cause of *pain* is the use of injection fluid *at a lower temperature than that of the body.* To obviate this, it is well to make use of solutions the temperature of which is about the same as the body temperature. This precaution is not often observed, and, let us add, without any appreciable injury to the patient.

The escape of part of the injection is due either to negligence on the part of the operator, or to the use of a canula with too large a calibre.

If the *choice of situation* for making the injection is not without its importance in regard to absorption, it is not of less consequence in regard to those accidents which may supervene. As a general rule, the farther the injection is made from the trunk, the greater is the liability to local complications. Account must be taken, (1) of the irritation which the friction of garments, walking, manual work, etc., may cause at the punctured point; (2) of the greater or less looseness of the subcutaneous cellular tissue; (3) lastly, it is desirable to

avoid, unless for some special reason, (*a*) the neighborhood of great vessels; (*b*) highly innervated regions; (*c*) those parts where the skin is separated from the bone only by a thin layer of adipose tissue (as, for instance, over the internal surface of the tibia); (*d*) the immediate neighborhood of the joints, except in special cases.

Cachectic individuals, bleeders, diabetics and alcoholics, all subjects predisposed to sundry accidents, require the utmost care in the operative procedure. In another class of cases it is prudent to abstain from making hypodermic injections, or at least to use antiseptic precautions, as in instances of infectious disease, erysipelas, etc.

Accidents may arise from the powders, deposits, fungi, and crystals which may be formed in too concentrated solutions, which either exist from the first in the solutions or are developed later on. It is sometimes possible in this case to restore the solution to its original condition by heating it in a water-bath at the temperature of the body, but it must not be forgotten that too concentrated solutions of certain salts often give rise to inflammatory troubles. Finally, the medicine itself may be at fault, if it is only held in suspension, as in the case of calomel, or if it is little or not at all capable of being absorbed (accumulation of mercury [*emmagasinement*] of M. Luton).

Many solutions should be prepared when required; some may be kept an indefinite time by taking the precaution to add a few drops of salicylic or carbolic acid in solution.

We will not enlarge more on the accidents due to the irritating properties of the liquids or of the substances in solution. Full details will be found in the several notices on particular remedies, as well as in the sections on Local accidents and Solutions.

A few rare cases of *tetanus*, which were attributed to injections of sulphate of quinine, have been published, but these observations do not appear to be free from cavil.

Injections should never be made on the nose, ears, eyelids, different parts of the neck, scrotum, axilla, groin, fingers, etc., nor on œdematous regions or parts which are the seat of stasis, inflammation, or extravasation.

The local troubles which have occurred, more especially in the infancy of this method, have often been due to imperfec-

tions in the instrument employed, to undue size of the canula, to the irritating property of the drug, and to the faulty performance of the operation. All who have had considerable experience in hypodermic injections find that the number of these accidents diminishes with practice.

TO THE READEP

We thought it would be useful to devote a special paragraph to a resumé of the physiological effects of each drug. We have consulted the best works which have been published down to the present time, avoiding, as far as possible, controverted points. We have often had to quote facts which are as yet somewhat obscure; but we must remark that if, in such cases, our explanation is not quite satisfactory, the fault lies in the contradictory results obtained by various physiologists, either because the substances experimented on by them have not been chemically identical, more or less pure, or unstable, or, perhaps, because of the erroneous interpretation of physiological experiments. Vulpian says: "I have always, for my part, strenuously opposed this deplorable tendency to apply prematurely to pathology the still uncertain deductions of experimental physiology."

Many of the formulæ in this Manual must be entirely abandoned. Some leave much to be desired in regard to their composition, or, on the other hand, possess such irritant properties that they cannot be employed; others rank as poisons or have been insufficiently investigated; nevertheless, we did not deem it right to pass them over in silence, (1) because they possess an historic interest, (2) because they may throw light on future investigations.

In all quotations, to avoid responsibility, we have been careful to append the names of authors. When we have made original investigations we have stated our own results in detail. Finally, we are responsible only for a comparatively small number of formulæ.

We may make this general observation, that the practitioner should not depend merely on the normal physiological effects of poisonous solutions, but that he should also in each individual case, and above all in the case of alkaloids, bear in mind that a drug which is not eliminated may induce disas-

trous results: thus, the administration of active drugs in renal affections should be always guarded against.

We do not deny that, in spite of our utmost care, our undertaking is still imperfect, the field traversed by us embracing, as it does, nearly every therapeutic agent. In order that this work may be rendered more accurate we appeal to all our readers, and assure them that we shall welcome any correction, of whatever nature it may be, provided of course that it is well founded; corrections of names, dates, etc., as well as any criticism or communications regarding fresh discoveries, and we promise to find room for them, if possible, in a new edition.

We have purposely omitted any reference to injections which exert a purely local effect, to alterative interstitial or parenchymatous injections, which, properly speaking, do not fall within the scope of the hypodermic method. Intravenous medicinal injections, as well as injections into the serous and other cavities, and transfusions, do not find a place in this work.

MANUAL OF SUBCUTANEOUS INJECTIONS.

ACIDUM ARSENIOSUM.

ARSENIOUS ACID. (*See Arsenium.*)

ACIDUM BENZOICUM.

BENZOIC ACID.

This acid is slightly soluble in cold water (1 in 200), more so in boiling water (1 in 15), in glycerin (1 in 10); very soluble in alcohol, ether, and oil of turpentine. [According to Squire, borax aids its solubility in cold water—one of borax and one of acid being soluble in 100 of water.—*Trans.*]

Principal Physiological Effects.—Arrests fermentation and putrescence. Is eliminated by the perspiration, saliva (as succinic acid), the kidneys (as hippuric acid), and the lungs (when the dose exceeds 15 to 30 grains).

In this dose (which is considerable) it gives rise to no remarkable phenomena. According to Schreiber, in doses of about four drachms, it induces feeling of weight in the head, increased rapidity of cardiac contractions, increased perspiration, and the expectoration of large quantities of mucus. (Benzoic acid is chiefly used as an expectorant and as an excitant.)

Local Effects.—The solution employed by Rohde caused great pain, but even the strongest solutions, in his hands, never gave rise to abscess or ecchymosis.

Formulæ.—The solution used by Rohde in a case of nephritis with threatened uræmia (1871) was as follows:—

Benzoic acid, ...	10 grains
Alcohol, ...	up to 112 minims.

Dose from 8 to 16 minims (about ¾ of a grain to a grain and a half of benzoic acid). Both solution and syringe should be warmed to a temperature of 95° F.

In a case of pneumonia with difficult expectoration, unconsciousness, stertorous breathing, cyanosis, small and frequent pulse, the same author obtained a rapidly favorable result from eight injections in one hour of this solution. About seven grains altogether were injected.

Alcoholic solution of benzoic acid (1 in 12),
Alcoholic solution of camphor (1 in 12), of each 12 minims
Alcohol, ... up to 144 minims.

A syringeful or 16 minims repeated several times (Leyden and Rabow). The solution of camphor in the formula may be increased to 18 minims (Rohde).

We have had occasion to make use of this solution, as well as of the following, several times, neither of them seeming to excite any pain; but it is right to observe that we were treating a case of epilepsy with dementia, and it is probable that the sensibility was dulled. A solution containing equal parts of benzoic acid and camphor caused indurations which persisted for several days; and a solution of benzoic acid in equal parts of alcohol and water produced sometimes puffiness and redness of the skin, at other times abscess.

Benzoic acid, ...	25 grains
Alcohol, ...	160 minims
Distilled water, . . .	up to 320 minims.

Warm the fluid to 95° F., to insure complete solution of the benzoic acid, and inject, at intervals of five minutes, 64 minims in all of the solution (1¼ grains of benzoic acid in each syringeful, that is, 5 grains altogether).

Rohde has employed this solution without success in a case of uræmia.

Therapeutic Uses.—In pneumonia, typhus, uræmia, collapse, etc. Benzoate of sodium, which is soluble in two parts of water, appears to be possessed of more active properties than benzoic acid, but we do not think it has been administered hypodermically as yet. It has been administered in doses of four scruples to six drachms in diphtheria, phthisis, puerperal fever, etc. Benzoic acid has been also recommended in the

treatment of chronic bronchitis, cystitis, and gout. See Brunton's "Pharmacology and Therapeutics," p. 880. Neale's "Digest," 393–5.—*Trans.*]

ACIDUM CARBOLICUM.

Carbolic Acid. Phenol.

Carbolic acid (C_6H_5HO) is a derivative of benzol, soluble in 50 parts of water (chemically pure acid is soluble in 20 parts, Binz, Hager), and in all proportions in alcohol, ether, bisulphide of carbon, and glycerin. Concentrated aqueous solutions can be prepared by mixing equal parts of carbolic acid and glycerin, when water may be added in any proportion.

Absorption is rapid even through the unbroken skin (Husemann, Hoppe-Seyler). Elimination is rapidly effected through the skin, lungs (with characteristic odor of the breath), and the kidneys. In the urine we find carbolic acid transformed into phenol-substitution products:—(*a*) if introduced into the body in small quantities,—under the form of sulpho-carbolic acid (phenol-sulphate), nontoxic; (*b*) if it has been injected in large doses,—in the form of another phenol-substitution product, the nature of which has not yet been ascertained (Baumann).

The urine, without necessarily being largely charged with carbolic acid (Salkowski), often assumes a grayish-green color, more especially after absorption from the skin or from a wound; sometimes, but rarely, there is albuminuria, especially after large doses.

Principal Physiological Effects.—Antiputrescent and antifermentative. In a dose of seven grains, it produces in man no serious result. In doses of from seven grains to half a drachm the effects are general excitement, then stupor, vertigo, humming noises in the ears, deafness, languor, sweats, diminution of the pulse rate, fall of temperture, colic, diarrhœa.

In poisonous doses, vertigo, giddiness, tingling in the fingers, intoxication, delirium, stupor, analgesia, anæsthesia, muscular debility, intermittence and then arrest of the heart in diastole; rarely convulsions, contrary to what we find in animals, collapse, coma, death.

Antidotes.—Saccharated lime (Husemann); sulphate of

sodium and other sulphates (Baumann); inhalations of oxygen, bleeding, transfusion (Ferrand).

Local Effects.—Sensation of burning, disappearing generally after half an hour; in moderately large doses (Hueter's two-per-cent solution) production of small ecchymoses, but without abscess.

Carbolic acid, ...	1 grain
Distilled water, . . .	up to 112 minims.

Dose, eight to sixteen minims = $\frac{1}{14}$ to $\frac{1}{7}$ of a grain of acid ("Formulary of Vienna Clinique").

Carbolic acid, ...	2 grains
Distilled water, . . .	up to 112 minims.

Hueter (erysipelas, four half syringefuls [32 minims] in the healthy skin round the erysipelatous spot), Hirschberg, Aufrecht, Schnitzler (phthisis), Fleischmann (prurigo eight to sixteen minims at the affected part:—one injection every second or third day: total number 3–15).

Carbolic acid, ...	1 grain
Distilled water, . . .	up to 80 minims.

This solution has been used in traumatic erysipelas; five or six injections of 16 minims are made into the healthy skin around the erysipelatous patch at a distance of 1 centim. (0.39 of an inch) from the red margin and at several points; they are repeated a second time in the same day, and the treatment is pursued until fever subsides and there is arrest of erysipelatous inflammation (duration 3 to 4 days). We have seen it employed with success at Strasbourg, in the practice of M. E. Bœckel. In an article published in the "Gazette Médicale de Strasbourg," May, 1875, M. E. Bœckel concludes by saying that these injections often allow of the arrest of severe attacks of erysipelas in two days. Nevertheless, he records in this same article one case of death.

Carbolic acid, ...	1 grain
or " "	3 grains
or " "	5 grains
Distilled water, . . .	up to 112 minims.

The above solutions have been employed by Jessier (1868) in cases of intermittent fever.

Sulphate of quinine, ...	1 grain
Sulphuric acid, ...	q. s.
Boiling water (!!), ...	90 minims.

Allow to cool and then add:—

Carbolic acid, ...	4 grains.

Lente has injected 18 to 24 minims and more of this solution without causing abscess. [The formulæ that appear to us most suitable, are those used in the cliniques, at Vienna, of Hueter, and especially of M. E. Bœckel. Five-per-cent solutions are too strong for hypodermic use.—*Trans.*] Carbolic and salicylic acids are in this way often employed to prevent decomposition of hypodermic fluids.

"Carbolate of ammonia" has been used as a hypodermic injection in typhoid fever (Déclat).

Therapeutic Uses.—Intermittent fevers (Jessier, 1868, 26 cases, 15 recoveries; Déclat, 1869, publ. in 1873; Hueter, Hirschberg, Aufrecht, Motta, who made injections into the back and splenic regions without general or local mishaps (25 cures, 8 failures. He preferred carbolic acid to sulphate of quinine, especially in hospital practice, etc.); prurigo (Rezek, Fleischmann); diphtheria (Trotz, etc.); phthisis and tuberculosis (Schnitzner, Eliacopulos); crural neuralgia, pleuro-pneumonia (Hagen, Kunze); various neuralgiæ (Schrumpf); typhoid fever (Déclat); diabetes, malignant pustule, carbuncle, malignant œdema (Raimbert, Méplain, Verneuil, Trélat (solution 1 in 50), Marchisio (1879), Giovannetti, Maffucci (1881), etc.); nævus (Badley); acute articular rheumatism (injections made in the neighborhood of affected joints; salicylic acid and salicylate of sodium *per os* are preferable to carbolic acid hypodermically. Bergonzini, Senator, Kunze and Goldbaum); puerperal diseases (Chiarleoni, unsuccessfully); anthrax (Olavide); Ludwig's angina (parenchymatous injection of 2-per-cent solution).

Skibnewsky's formula.

Carbolic acid, ...	1 part
Distilled water,	
Alcohol, ...	of each 2 parts.

ACIDUM HYDROCYANICUM. POTASSII CYANIDUM. AQUA LAURO-CERASI.

Hydrocyanic Acid. Prussic Acid. Cyanide of Potassium. Cherry-Laurel Water.

Hydrocyanic acid is soluble in water and alcohol in all proportions. Cyanide of potassium is readily soluble in water, in alcohol, and in glycerin (ab. 1 in 3).

Principal Physiological Effects.—Bitter taste, feeling of heat, burning, and then numbness of the tongue, pharynx, and stomach; salivation; increase in number of respirations, which become most painful; elevation of blood-pressure, slowing of the pulse, spasmodic phenomena.

In larger and poisonous doses, nausea, vomiting, cephalalgia, giddiness and fainting; difficult respiration (slow or frequent), dilatation of the pupils, lowering of blood-pressure and temperature, feeble then imperceptible pulse; general tonic and clonic spasms; sensory and motor paralysis; coma and death by asphyxia. Cyanide of potassium is much less potent than hydrocyanic acid; it possesses similar properties and is prescribed in doses of from one-seventh to three-quarters of a grain, cautiously increased to two and a half or three grains.

Local Effects.—Distilled cherry-laurel water possesses distinctly irritating properties [Messrs. Dujardin-Beaumetz and Lailler have never met with mishaps from the subcutaneous injection of cherry-laurel water; its irritating properties were found to be due to acidity from oxidation by contact with air]; cyanide of potassium even in very feeble doses (one per cent) gives rise to pain which is almost as severe as that which would be caused by the injection of an equal quantity of saturated solution of sodic chloride. It does not cause suppuration. Hydrocyanic acid has a somewhat irritating action similar to that produced by morphine. Cherry-laurel water, recommended by Luton, is chiefly used as a vehicle for hypodermic solutions (see atropine, morphine, etc.); it forms perfectly clear solutions with morphine which will keep an indefinite time. Cherry-laurel water of the German pharmacopœia contains one part of hydrocyanic acid in 1000; that of the French pharmacopœia less than half that quantity. Dr. Bartholow has used prussic acid of the United States pharmacopœia

hypodermically in doses of two to four drops. He thinks that four drops is too large and even a dangerous dose, and that it is prudent not to exceed that of two drops, which, however, may be repeated frequently, owing to the rapid elimination of the acid.

Hydrocyanic acid (2%), . . .	10 minims
Distilled water, ...	60 minims.

From two to six minims.

Cyanide of potassium, ...	1 grain
Distilled water, . . .	up to 112 minims.

Therapeutic Uses.—Mental diseases, especially puerperal mania (Macleod) [this author made use of Scheele's acid. French hydrocyanic acid for medicinal use is 1 per cent. —*Trans.*]; mania and melancholia (Macleod, Bartholow); eclampsia (Macleod); angina pectoris, gastralgia, functional vomiting (Bartholow). Cherry-laurel water, in doses of half a drachm, has been injected in lumbago by Estachy. [32 minims of aqua lauro-cerasi of the French Codex = 16 minims of the British pharmacopœial preparation, or about $\frac{1}{2}$ of a minim of the Acid. hydrocyan. B.P.—*Trans.*]

Antidotes.—Preyer has asserted that atropine is a physiological antidote to prussic acid. The experiments of Bartholow do not support this view. [Inhalaton of ammonia was shown to be an antidote, as far back as 1822, by Murray, but it is of little or no use administered by the stomach. I would suggest that it may be an efficient antidote administered hypodermically or by intravenous injection. *See* Christison "On Poisons," 4th edit., p. 777.—*Trans.*]

ACIDUM OSMICUM.

Osmic Acid.

This acid, originally employed in the treatment of tumors by interstitial injection (Winiwarter, Delbastaille, etc.), has been employed by Billroth, Neuber, Eulenburg, Lipburger, Merces, and others, in the treatment of obstinate neuralgia with various results.

Osmic acid, crystallized, . . .	1 grain
Distilled water, . . .	up to 112 minims.

The solution should be kept fresh in a vessel of black glass or of lead. Prof. Eulenburg has not met with any instance of local or general disturbance from its use, but other authors have reported gangrene of the skin, œdema with greenish discoloration, etc.

Dose.—Eight to sixteen minims of this fluid may be injected = $\frac{1}{14}$ to $\frac{1}{7}$ of a grain.

ACIDUM PHOSPHORICUM.

Phosphoric Acid.

According to M. Michalski (Thèse de Paris, 1868), phosphoric acid has been employed hypodermically in the treatment of the hæmoptysis of phthisis.

ACIDUM SCLEROTINICUM.

Sclerotinic Acid.

Sclerotinic acid, isolated from ergot of rye by Dragendorff and Podwissotzky, is a brown substance without taste or odor, faintly acid; it is hygrometric but is not deliquescent. The chief symptoms observed by Nikitin[3] after the administration of sclerotinic acid, which acts chiefly on the central nervous system, were paralysis, lowering of blood pressure, and enfeeblement of cardiac contractions (in cold-blooded animals); in acute poisoning, fall of temperature continuing until death; slowing of respiration and its total arrest, in the event of death, before cessation of circulation; in warm-blooded animals increase of peristalsis. Nikitin found, moreover, that sclerotinic acid induced uterine contractions, whether there was pregnancy or not, and strengthened already existing contractions. Before and during contractions he observed discoloration of the uterus. He attributes the hæmostatic action of sclerotinic acid in pulmonary hemorrhage to diminution of blood pressure, while, in uterine and intestinal hemorrhages, he thinks the same result is due to anæmia produced by vascular constriction which follows upon injection of the acid.

Rennert used it for hypodermic purposes in an aqueous solution of 1 to 2. These injections, he says, are extremely painful. The solution which M. Prévost of Geneva used, was composed as follows:—

Sclerotinic acid,	3 grains
Glycerin,	44 minims
Distilled water,	up to 112 minims.

More recently M. Prévost has substituted with advantage carbolic acid for glycerin; the solution thus made keeps good an indefinite time. The formula is subjoined:—

Sclerotinic acid,	3 grains
Carbolic acid,	½–1 grain
Distilled water,	up to 12 minims.

In 1882 we employed this solution at the Bicètre in the treatment of epilepsy in a certain number of cases; in doses of ½ to 4½ grains by hypodermic injection, the maximum dose being 9 grains, we observed neither local nor general accidents, and the pain was nil. The therapeutic results were negative in nearly all the cases; in five patients we observed slight amelioration. The duration of treatment varied from six months to a year.

In these formulæ the Pravaz syringe of one gramme (16 minims) contains ¾ of a grain of sclerotinic acid; which is the quantity which Dragendorff and Podwissotzky indicated as the adult human dose.

According to the researches of Nikitin, the smallest dose which produced uterine contractions in animals was 0.2 gramme (3 grains). The same author states the fatal dose for man at 155 grains.

Stumpf, in the clinique of Ziemssen at Munich, at first employed sclerotinic acid in the doses recommended by Dragendorff and Podwissotzky, but finding this dose insufficient he raised it to 9 grains, repeated at the most 3 or 4 times a day (6-per-cent aqueous solution) by hypodermic injection. Kobert has administered sclerotinic acid in a dose of 16 grains daily. M. Sotschaw (1881) stated that he had obtained better results in uterine fibroma from the use of sclerotinic acid, in 5-per-cent solution, than from the injection of ergotin.

Recent experiments by M. Queirolo ("Italia Medica," 1884, No. 25) show that sclerotinic acid in doses of from ¾ grain to 2¼ grains hypodermically, or ʒ ss. to ʒ i. by internal administration, exerts no action on vascular calibre and does not increase the pulse rate. Ganguillet employs sclerotinate of sodium.

Therapeutic Uses.—The indications for the use of this drug are the same as those for ergot of rye and ergotin.

[*A propos* of this subject see two important papers on the principles of ergot by Dr. Kobert of Dorpat.[4] He describes 3 active principles in ergot, viz., ergotinic acid, sphacelinic acid, and cornutin. (1) Ergotinic acid is the active principle of Bonjean's extract, of Wernich's dialyzed ergotine, and of the sclerotinic acid of Dragendorff and Podwissotzky. It is 5 times as powerful as sclerotinic acid. Hypodermically injected it causes paralysis—beginning in brain and spinal cord—paralysis of vaso-motor centre, and lowering of blood pressure. In the largest doses it causes no uterine contractions, and it does not cause gangrene. About 90 per cent escapes absorption. It is a glucosidic acid. (2) Sphacelinic acid in poisonous doses induces death with symptoms of gangrene. (3) Cornutin is not to be confounded with the ergotinine of Tanret. The latter is quite inert. The former induces uterine contractions both in pregnant and in non-pregnant animals; in non-pregnant animals it also causes vomiting, diarrhœa, and irregular pulse. Abortion could always be produced in dogs and cats by injection of cornutin ($\frac{1}{3}$ grain) without risk to the mother.

Cornutin acts reflexly on the uterus through a spinal centre; sphacelinic acid acts directly on the uterus itself. The latter in sufficient doses never failed to lead to expulsion of the fœtus in dogs and cats, and none of the mothers died. Kobert adds that the only rational preparation of ergot is one which contains all the cornutin and sphacelinic but no ergotinic acid; for the latter is very injurious to the stomach, and has no action on the uterus.—*Trans.*]

ACIDUM SULPHO-ICHTHYOLICUM. (*See Ichthyol.*)

ACIDUM TANNICUM.

Tannic Acid. Tannin.

Tannin has been used as a derivative by Messrs. Luton and Schwalbe in doses of from 16 to 32 minims of a 1 in 10 or 1 in 5 solution. Iodo-tannate solutions, which have been recommended by Guilliermond in the treatment of varix, are not within the scope of this work.

[A series of interesting and important researches have recently been carried out by Messrs. Arthaud and Raymond, on the etiology and treatment of tuberculous diseases. Six rabbits were treated for a month with doses of eight to sixteen grains of tannin. "In spite of two successive inoculations, one affected with pulmonary substance taken from a guinea-pig which had died from acute tuberculosis, the other inoculated with miliary tubercles from a hospital patient, no trace of infection was observed, while three other rabbits to which tannin had not been given succumbed in consequence of the inoculations." In consequence of these results, over fifty tuberculous patients were treated with considerable doses of tannin with the most encouraging results, and it has been concluded that patients under the influence of the tannin treatment show increased resistance to the tuberculous virus. Assuming the accuracy of these results and of the deductions drawn from them, it would appear as if some tangible benefit might be derived from the treatment of phthisis by hypodermic injections of tannin; —nay, more, it does not seem unreasonable to surmise that some part at least of the benefit accruing from the administration of tannic and gallic acids in the treatment of hæmoptysis, may find its explanation in something above and beyond the astringent action of these drugs.—*Trans.*]

ACONITUM. ACONITINA.

Aconite. Aconitine and its Salts.

Aconitine occurs in two forms, viz., amorphous and crystallized; it is inodorous, has a bitter taste, is insoluble in glycerin, slightly soluble in water, soluble in acidulated water, alcohol, ether, chloroform, benzol. All its salts, especially the sulphate, are freely soluble in water.

Principal Physiological Effects.—Slowing of pulse and respiration, shooting pains in the first division of the 5th nerve; pricking and tingling sensations of the skin, especially of the face, round the nose, of the lips and extremity of the tongue; alteration of the sense of taste (saccharine substances recognized with difficulty); noises in the ears, vertigo, debility and languor.

In Larger Doses.—Intensification of these symptoms—

sense of burning at tip of tongue, feeling of cold, of constriction of extremities, languor, somnolence, sense of weight in the head, pupillary dilatation, increase of urinary secretion, of sweat and of saliva; tendency to syncope.

In Poisonous Doses.—Nausea, vomiting, convulsions, fibrillary muscular twitchings, loss of the reflexes, motor incoördination; extreme prostration, complete anæsthesia, steady fall of temperature and pulse; inaudible voice, muscular paralysis and disappearance of muscular contractility coincidently with loss of motor nerve power (Mary, Thèse, 1880; this opinion contradicts the experimental results obtained by Aschscharumow, Bohm, Gréhant and Duquesnel, Rabuteau, etc., who attribute to aconitine an elective affinity for the terminations of the motor nerves; in small doses, according to these authors, aconitine resembles in its action that of curare in large doses; it acts primarily on the heart [arrest in diastole]); coma and death by asphyxia.

The *preparations* of aconite are very untrustworthy and their results are most uncertain; this uncertainty depends on the source of the drug and on the part used (preparations made from the fresh root are more active). Duquesnel's aconitine is the most active; the *amorphous* German aconitine is 20 to 50 times less powerful.

In consequence of a case of poisoning, followed by death, from Petit's (Paris) nitrate of aconitine, Messrs. Plugge and Huisinga undertook experiments to determine the toxic power of various samples of aconitine nitrate. The nitrate of Petit, in white crystals, was hard and difficult of solution in cold water; that of Merck, a yellow-brown powder, was easily soluble in water; that of Friedländer in thick gummy masses, of grayish-white color, was freely soluble in water. Their experiments showed that Petit's aconitine was 8 times more poisonous than Merck's, and one hundred and seventy times stronger than that of Friedländer. The German samples of aconitine, moreover, were not always of the same quality.

Aconitine and its salts should only be used with the utmost caution. The first dose should be no more than $\frac{1}{200}$ to $\frac{1}{130}$ of a grain, should scarcely ever exceed $\frac{1}{32}$ of a grain, and only with the utmost caution may be increased to $\frac{1}{13}$ of a grain (!) by degrees in cases where there is no sign of toxic effects.

[Martindale and Westcott[5] give the following scale of doses

for internal administration—$\frac{1}{240}$ to $\frac{1}{60}$ grain—may be carefully increased up to $\frac{1}{24}$ of a grain. They recommend English aconitine (Morson's) which is intermediate in strength between Petit's, the strongest, and Friedländer's, the weakest.[6] Their formula for hypodermic use is subjoined.—*Trans.*]

Antidotes.—Richardson has used with success hypodermic injections, and Wood has used, unsuccessfully, intravenous injections of ammonia in aconite poisoning. Finally, "even when the cardiac contractions are gravely affected or have actually ceased, it is possible to re-establish them by the artificial stimulus of electricity."—(Mary.)

Local Effects.—An alcoholic solution of sulphate of aconitine (1 in 500), first employed by Gubler, produces an intense sensation of heat, and occasionally a sense of burning which persist for a considerable time. This local action doubtlessly depends on the nature of the vehicle used for the solution.

Aconitine,	1 grain
Sulphuric acid,	a sufficiency to effect solution
Distilled water,	up to 560 minims.

Sixteen minims = $\frac{1}{35}$ of a grain of aconitine.

Nitrate of aconitine,	$\frac{1}{2}$ grain
Distilled water,	up to 1120 minims.

Sixteen minims = $\frac{1}{70}$ of a grain of the salt (Gubler, Mary). Erlenmeyer has used without success the following solution:

Aconitine,	2 grains
Alcohol,	140 minims
Distilled water,	up to 280 minims.

Each minim = $\frac{1}{140}$ of a grain.

Alcoholic extract of aconite,	1 grain
Distilled water,	up to 64 minims.

Lorent uses this solution in doses of from 4 to 10 minims in rheumatic cephalalgia.

[The following is Martindale and Westcott's formula—

Aconitine (English),	1 grain
Diluted sulphuric acid,	q. s.
Distilled water,	to $\frac{1}{2}$ fluid ounce.

Dose one to four minims.—*Trans.*]

Therapeutic Uses.—Neuralgia—especially of the trigemi-

nal (Gubler); cephalalgia (Lorent, Oulmont, Massini); acute (rendered superfluous by the introduction of salicylic acid) and chronic rheumatism (Lorent, Eulenburg); arthritis deformans (Lobl); prosopalgia (Pletzer); angina pectoris; whooping cough, etc.

Aconite and its preparations have, moreover, been recommended and used in cardiac hypertrophy, tetanus (Wunderlich), intermittent fever, and puerperal fever. In Geneva it is largely used at the beginning of certain acute affections of the respiratory organs, but to the best of our knowledge it has not been used hypodermically by any practitioner except Lorent, who administers the alcoholic extract.

ÆTHER.

ETHER (SO-CALLED "SULPHURIC")

Including remarks on Acetic and Nitric Ethers and on Spirit of Ether or Hoffmann's Anodyne.

Ether (ethylic ether, often misnamed "sulphuric" ether), is soluble in nine parts of water and in all proportions of alcohol.

Principal Physiological Effects.—In moderate Doses.—Elevation of temperature (the rise being more marked the lower the temperature of the body before injection, Dupuy), increase of arterial tension, of pulmonary combustion, of all secretions except the urinary (Ocounkoff), excitement, exaltation of the senses and of cutaneous sensibility, dilatation of the pupils. Anæsthesia by hypodermic injection is only produced by a much larger dose than that required by inhalation, and then the opposite effects to those described above are observed.

In dogs the dose required to produce anæsthesia varies from 1½ to 3 ounces, according to the animal's weight (Ocounkoff).[7]

Local Effects.—Momentary but excessively acute pain, without, however, inflammation or subsequent suppuration (Luton, who has met with abscess in a case of severe variola, but it is the only known case of the kind); sometimes the pain is absent (Dupuy). M. Luton and later M. Henrot (typhoid fever with hyperpyrexia) have observed at the point of puncture a circumscribed subcutaneous emphysematous swelling, due

to the evaporation of the ether, which has a boiling point of 36° (96.8° F.). According to M. Luton absorption is not too rapid, but all the facts reported by other authors are opposed to this opinion.

After injections of ether, disturbances of motion and sensation have been observed (Arnozan and Salvat, Charpentier, Remak). The etiology of these accidents is still obscure, nevertheless Messrs. Arnozan and Salvat believe, from their experiments, in the existence of a neuritis. It follows from the great diffusibility of ether that the injection should not be too large, should not be repeated a second time at the same point, and should not be pushed beyond the cellular tissue.

Doses.—Sixteen to thirty-two minims, or even less, often suffice to produce a stimulant action (Dupuy). The action of ether being eminently transient, the injections should be repeated at short intervals (*e.g.*, of an hour) to obtain the phenomena of excitement.

Spirit of ether (Hoffmann's anodyne) has been used as an analeptic by Zuelzer, and *acetic ether* by Bumüller.[8] [The spirit of ether of the *Germ. Pharm.* is merely a solution of ether in alcohol, and contains no oil of wine, as does the compound spirit of ether of the U. S. P.—R.]

Ether in combination with camphor has been injected subcutaneously by Messrs. Eulenburg (collapse due to facial erysipelas), Mader and Oser (cholera). M. Burdel has combined it with sulphate of quinine, 6 grains to 16 minims, in severe cases of pernicious intermittent affections. M. Zuelzer appears to have been the first to make use of subcutaneous injections of ether (1866) in choleraic patients, and, in 1871, in patients suffering from adynamic typhoid. Since then it seems that numerous authors have used ether hypodermically. Ether has thus been employed among others in the following diseases: typhoid fever, algid stage of cholera (Hans Böchner, 1873, Dupuy, Lindwurm, Reyher and Lermoyez), profound coma with coldness (92.5° F.) due to obstinate and excessive hemorrhage after extraction of a naso-pharyngeal polypus (Verneuil), in poisoning by morphine and chloral (Lewenstein), in sciatica and lumbago (Brindley James), in dropsies (fatty heart), in convulsions followed by coma in a child at the beginning of pneumonia (Gellé), cholera nostras (Cérenville, Dufour, Leube), traumatic shock (Bayr, 1874, Dupont), variola (Luton, Du

Castel, Dreyfus-Brissac), lipothæmia as a result of repeated puerperal hemorrhages (Bayr, Letulle, Peter and Verneuil), poisoning by aconite (Warington, Howard), hemorrhages (Weir Mitchell, Ortille, Hecker, etc.), pelvic peritonitis complicated with obstinate vomiting and alarming collapse (Schmeltz), *post-partum* hemorrhage (Macau, 1876), hemorrhage due to mal-insertion of placenta (Lombe Atthill, Chantreuil, who combined it with cognac), ovariotomy followed by depressed temperature (Olshausen), in impending death (Amalai Gimeno, 1880), as an adjuvant to chloroform narcosis (Fritsch). Messrs. Bayr, Verneuil and Mlle. Ocounkoff have proposed injections of ether as a substitute for transfusion of blood in hemorrhages. M. Hayem, on the other hand, is in favor of transfusion with non-defibrinated blood. According to this author, injections of ether are only indicated in cases of syncope or prolonged lipothæmia.[9]

In short, excellent results are obtained from the diffusible action of ether in patients in a condition of extreme adynamia (Dupuy), of complete collapse (Zuelzer, Winckel, Osterlah, etc.), coma (Verneuil), lipothæmia (Letulle), asystole (Huchard, Bellardinelli).

Ether is also frequently used with advantage as a vehicle and solvent (*e.g.* for hydrate (not sulphate) of quinine, etc.). We have had the opportunity of examining in the cadaver the results produced locally on the cellular tissue by injections of ether; we found a small ecchymosis of slight extent affecting nearly the entire thickness of the adipose tissue. Ether has been injected interstitially in the treatment of wens by M. Vidal (5 to 10 minims every two days).[10]

[See a paper by Dr. T. More Madden on uterine hemorrhage and the hypodermic injection of ether in the "Brit. Med. Jour.," 1880, vol. i., p. 592. Dr. Madden in the same volume, p. 997, draws attention to the fact that ether dissolves the cement by which the joints of the syringe are secured, and describes one devised by himself in which "the screw is cut on the cylinder, which is graduated, and the instrument is so arranged that it may either be used for throwing in a large dose of ether by a single movement of the piston, or for the gradual injection of the smallest quantity of any other fluid."—*Trans.*]

AGARICINUM.

AGARICIN.

Agaricin, obtained from Agaricus albus, has been extolled by Seifert, Piering and others, by whom it has been used to check excessive perspirations (phthisical and others) in doses of from $\frac{1}{14}$ to $\frac{1}{7}$ of a grain. It diminishes the frequency of the cough without inducing either nausea or diarrhœa. Sleep is more tranquil and uninterrupted. As its maximum of activity is only attained 5 or 6 hours after administration, it is necessary to give it at various times according to the nature of the disease under treatment. M. Seifert[11] has sometimes employed it hypodermically.

Agaricin, ...	1 grain
Absolute alcohol, ...	90 minims
Glycerin, ...	up to 224 minims.

An entire syringeful = $\frac{1}{14}$ of a grain, may be used at one time. Seifert discourages the use of agaricin hypodermically, because of the intense burning sensation which it causes, and also because it offers no advantage over administration by the mouth.

The doses recommended by M. Seifert have since been exceeded by several observers, but the results obtained were not constant. This substance is of much less therapeutic value than atropine.

[See an interesting paper by Dr. Murrell on Agaric in the "Practitioner," vol. 29, p. 321. Administered *per os* it is very apt to induce intractable diarrhœa. Dr. Murrell has found it of use in some cases of hæmoptysis.—*Trans.*]

ALBUMEN.

(*See Injectiones Nutrientes Hypodermicæ.*)

ALCOHOL.

Alcohol has been used hypodermically both by itself and also as a vehicle. Without speaking of its use in surgical operations on certain tumors or cavities, alcohol has been largely used as a diffusible stimulant (Zuelzer), in the treatment of local pains (Luton), or as a hæmostatic (Luton). We

have not found it superior in action to a saturated solution of sea salt. It produces at the point of contact a smarting sensation which speedily subsides. For hypodermic use, alcohol at a temperature of 90° F. is best. At a higher temperature there is risk of burning the tissues, and, even at this temperature, if the injection is made too near the extremities, there is the same risk. At a lower temperature the fluid tends to diffuse, and its local effects are proportionately less intense, but then one is administering a stimulating injection with a general action. The doses must be calculated according to the results that are aimed at; no definite dose can be fixed (Luton).

Alcohol injected under the skin is a good rubefacient, and particularly so at a temperature of 122° F. Its contact is not very painful and it produces neither abscess nor sloughs.

Flood made more than 200 injections of whiskey and coffee in four hours in a case of opium poisoning with complete success; at the same time he injected belladonna tincture in doses of 10 to 20 minims. Ainsworth (1881) injected half a drachm to a drachm of brandy in cases of collapse. [Edward Warren used hypodermic injections of brandy in 1867.] Breisky and Figuero injected brandy with good results in cases of acute anæmia due to puerperal hemorrhage or traumatism. In short the principal indications for the use of alcohol are found in severe cases of anæmia, in collapse, and in localized pain.

ALCOHOL AMMONIO-ANISATUM.

Ammoniated Alcohol with Anise. Ammoniacal Solution of Anise.

Zuelzer, of Berlin, has combined alcohol with ammonia in the following formula:

Oil of anise, ...	10 minims
Alcohol, 85%, ...	40 minims
Water of ammonia, ...	50 minims.

Fifteen to thirty minims of this solution in adynamic typhus. He has observed sometimes small abscesses as a result of this injection. Eulenburg has employed injections of ammonia and anise with slight success in several cases of collapse; he injected 5 to 7 drops of ammoniated solution of anise, sometimes by itself, at others mixed with an equal quantity

of distilled water. We have used this injection twice only, but without local troubles.

ALOE. EXTRACTUM ALOES. ALOINUM.

Aloes and its Extract, Aloin.

M. Luton has had occasion to make use of a watery solution of aloes. This was a solution of one-tenth and contained only those principles that are soluble in water.

Aloes, ... 10 grains
Distilled water, . . . up to 112 minims.
Filter.

16 minims = 1½ grains.

The local effects were almost nil or limited to a simple local hyperæmia which speedily vanished. The injection produced a decided laxative effect on a patient suffering from constipation in typhus; sixteen minims were injected under the skin of the fore-arm. An alcoholic preparation, or better still, one made with glycerin, would be preferable to that made with water. Solutions of the extract of aloes are of no use owing to the local irritation which they produce.

The aloin of Merck, a glucoside soluble in water and alcohol (Stenhouse),[12] has been employed by M. Fronmüller in aqueous solution (1 in 25), as a cathartic, without any local disturbance; its action is obtained in from 3 to 5 hours, except in cases of obstinate constipation. M. Fronmüller thinks that it is indicated in cases of gastric catarrh, cancer, and insanity. Aqueous solutions of extract of aloes and decoctions of senna cause local inflammation.

Dr. Klein alleges that aloin diminishes inflammation and intraocular pressure in glaucoma, acute keratitis, etc. Subcutaneous injections of aloin and of watery extract of aloes have been administered, hitherto without success, by Kohn[13] in the constipation of insanity. After the injection of strong doses of aloin in animals he observed a hemorrhagic ulcerative gastritis, and changes in the kidneys resembling those which ensue on poisoning by chromium salts. M. Hiller has experimented with a solution of 16 grains of aloin in 48 minims of warm glycerin; one to two syringefuls of this solution at one time produced, 5 to 6 hours afterward, a moderate purgative

action with abdominal pain. M. Bozzolo, of Turin (1883), was compelled to abandon these injections owing to the severe local disturbances to which they gave rise.

AMMONIÆ AQUA.

LIQUOR AMMONIÆ. FLUID AMMONIA. WATER OF AMMONIA.

Ammonia has been used hypodermically along with its internal administration, in the treatment of bites by venomous serpents; 30 minims diluted with an equal quantity of water, or, better still, one part of ammonia with four parts of water (Nothnagel and Rossbach). Dr. Willis Cumming has used ammonia injections in a case of alcoholism complicated with sunstroke (1883). Halford and Oré have practised intravenous injections of diluted ammonia in severe cases of serpent bites. [The translator has used 4 minims of liq. ammoniæ with 6 of water by intravenous injection in syncope from uterine hemorrhage in several cases with marked and immediate benefit.]

Monteverdi has used it with equal parts of peppermint water in a severe case of cholera, and this treatment was successful. M. Trusevich has used water of ammonia in cases of collapse, both by hypodermic and intravenous injection (2 to 5 minims of dilute ammonia). These preparations had previously been used by Halford, Penfold, Moceiben, Tibbis, Davidson, Cotton, Flint, and others. M. Hirsch, of Mayence, has used injections of sulphide of ammonium (Schwefelammonium) in the treatment of cholera. This author asserts that he has used it with success, but the theory upon which his treatment was based is quite untenable.

Liq. ammonii sulphidi, ...	1 dr.
Aquæ destillatæ, ...	3 drs.

A solution of equal parts produced sharp pain (sense of burning lasting an hour) and inflammatory phenomena.

Richardson, in a case of poisoning by tincture of aconite (see ACONITE), made an injection of ammonia after the pulse had ceased for ten minutes. This injection (about 40 minims) was repeated 4 times at intervals of ten minutes; four days afterward all trace of poisoning had disappeared. There was observed at one point of injection a small patch of sloughy skin.

Valerianate of ammonium has also been used hypodermically.

Ammonia and its salts are characterized by such excitant and stimulant properties that they are of the greatest service in the treatment of collapse in the most diverse diseases.

AMMONIUM, CITRATE OF.

(*See under Ferrum.*)

AMYL NITRIS.

Nitrite of Amyl.

Nitrite of amyl has generally been used in the form of inhalations.

The results obtained from its use by subcutaneous injections are uncertain (Amez-Droz). From 16 to 80 minims have been injected in the dog, and 90 minims in man in one and a half hours.

On post-mortem examination of animals which have been subjected to injections, nothing abnormal could be found, with the exception of a grayish discoloration (Guttmann); there is no suppuration. Dr. David B. Smith was the first, so far as we know, who administered amyl nitrite hypodermically in man. The case was one of cholera, a disease in which Hayden and Cruise had previously given inhalations of amyl without apparent benefit. Dr. Smith's patient died.

Nitrite of amyl, ...	10 minims
Alcohol, ...	90 "

(*Barnes.*)

Eight to twelve minims in lumbago. Dr. Barnes asserts that he has obtained the same physiological effects by hypodermic injection as by inhalations.[14]

Dr. Sidney Ringer mentions the case of a woman affected with chronic mania in whom Dr. Strahan injected 8 minims of a 10 per cent solution of amyl for the relief of lumbago; this was followed by two epileptiform attacks in close succession.[15]

[Dr. Barnes[16] advocates the use of amyl nitrite by inhalation (not by mouth) in cases of strychnine poisoning, and he attaches great value to its power of arresting, or, at least, controlling, diastalsis. He also recommends the use of this rem-

edy to subdue irregular and excessive action of the uterus, to overcome hour-glass contraction of the uterus, and to control puerperal convulsions.

Should unpleasant symptoms follow the subcutaneous administration of amyl nitrite, the antidote (used successfully in Dr. Strahan's case) is chloroform by inhalation.—*Trans.*]

ANTIHYDROPINUM.

ANTIHYDROPIN.

Antihydropin is obtained from the Blatta Orientalis (cockroach), and is used by the Russians for dropsy. It has been administered hypodermically by Wyschinski, but with negative results. M. Bogomolow has used it both in powder and in tincture in 70 cases of anasarca and ascites (cardiac, renal and hepatic affections); in 19 cases there was profuse perspiration, in 61 there was increase of urinary secretion, and in 13 cases catharsis, without irritation or other ill-effects, was induced. In uræmia the author injects a syringeful (Pravaz) of tincture.

ANTIMONII ET POTASSII TARTRAS.

ANTIMONIUM TARTARATUM. TARTAR EMETIC. TARTRATE OF ANTIMONY.

Soluble in water 1 in 15, in glycerin 1 in 18, insoluble in alcohol.

Principal Physiological Effects.—In small doses.—Administered every day for 14 days (experiments of Meierhofer and Nobiling on themselves) in doses progressively increased from $\frac{1}{10}$ to $\frac{1}{4}$ grain. Sense of weight in the head, debility, thirst with feeling of inward heat, drowsiness, frequent and irregular pulse, vertigo, pallor of face, ringed eyes, and dysphagia. Loss of appetite, sense of epigastric heat, frequent intestinal pains, nausea, anxiety, yawning, dyspnœa, painful abdominal sensations, diarrhœa or constipation, chilliness of the skin, feeble heart beats, general prostration and emaciation. In doses of $\frac{1}{4}$ grain continued for several days, eructations, efforts to vomit, frequent stools, increase of hepatic dulness with pain, colic and griping, itching of the skin, albuminuria, emaciation amounting to 12¼ ounces in ½ to 14 days.

The poisonous phenomena only disappear finally after two months.

In large doses (one-and-a-half grains and upward) there are symptoms of gastro-enteritis, prostration, thread-like pulse, which is also frequent and irregular, superficial respiration, cold sweats, cyanosis and death (rare in this dose, especially if the heart is healthy) from paralysis of the heart. Pustular eruptions, ulcerations and scars supervene on application to the skin.

Local Effects.—Very acute local inflammation with one-third of a grain, phlegmon and lymphangitis (Lehmann), with half a grain, syncope and phlegmon (Ellinger). Lissauer has also observed phlegmons after hypodermic injection of tartar emetic, but this salt if combined with morphine only gives rise to trifling, and sometimes to no local ill effects.

Tartrate of antimony and potassium,	1 grain
Morphine (tartrate ?), . . .	½ grain
Distilled water, ...	up to 64 minims.

16 minims = ¼ grain of antimony.

(*Lissauer.*)

Therapeutic Uses.—It may really be said that tartar emetic is hardly ever indicated except as an emetic. It has been used by various authors (Lehmann, Ellinger, etc.); it has been combined with morphine by Lissauer who recommends it in cases of poisoning where antimony cannot be administered by the stomach.

ANTIPYRINA.

ANTIPYRINE.

An artificially prepared organic base (phenyl-dimethyl-pyrazolon) derived from *pyrazol*, according to Knorr. Antipyrine appears in the form of white crystalline powder, of a grayish-yellow color after exposure to the air, soluble in 1 part of cold water, and in alcohol. It has a slightly bitter taste, and scarcely any odor.

A powerful antipyretic, its properties are identical with those of kairine, but its action is both more intense and more prolonged, and it produces no alteration in the blood (Huchard, Brouardel and Paul Loye, Arduin); in the period of reaction

there is no sign of rigors, that is, when the temperature increases again. It produces sometimes a moderate amount of perspiration [according to M. Huchard sweats do not occur when the antipyrine is given in divided doses (7 to 8 grains], vomiting, pharyngeal constriction, and a peculiar exanthem (Pribram, Cahn, and others), but collapse has never been noticed. Antipyrine is possessed of antiputrescent and hæmostatic properties (Arduin, Hénocque). Elimination is by the kidneys, and it may be detected 36 hours after its administration (Maragliano).

Antipyrine arrests the fermentation of yeast, and germination (Brouardel and Paul Loye).

The different results obtained are probably due to varying samples.

Doses.—M. Filehne, who first experimented with antipyrine, gave it in doses of 75 to 90 grains in three instalments at intervals of an hour; other authors have given as much as 135 to 155 grains. It is, however prudent only to increase the dose by degrees in case of any accident from collapse. In children, Messrs. Penzoldt and Sartorius advise to give at first every hour as many decigrammes as there are numbers of years (a decigramme = 1½ grains). The antipyretic effect would be more rapid and intense after hypodermic administration.

Used by a great many observers, it has chiefly been employed in the treatment of the symptom "fever;" Ranke (1884) was the first to use it hypodermically; he injected from 1 to 1½ c.cm. (16 to 24 minims) of solution of one gramme (16 grains) of drug in 8 minims of water. The solution when warmed retains its limpidity after cooling. Made in the gluteal region these injections only cause transient pain without any inflammatory reaction.

Erb, Hoffer, Huchard, Niepce, Mingazzini, Roussel, and Pavay also used hypodermic injections. The first three gave them up on account of the intense pain they caused, the others still continue to recommend them. The solution of M. Mingazzini contains 16 grains in 48 to 64 minims of distilled water; that of M. Huchard is composed of equal parts. The latter has found that the hypodermic method is somewhat painful; in his opinion it yielded less satisfactory results than that by internal administration.

M. Pavay used a 50-per-cent solution; he has injected three Levin syringefuls (capacity 40 minims) in one hour, or 54 grains of antipyrine. The effects are rapid. After each injection he manipulates for a few minutes the injected part (the gluteal muscles). He has never met with local accidents (sensation of burning, pain, or inflammation); he thinks, moreover, that these injections should invariably be resorted to when from any cause administration by the mouth is inadmissible.

[More recently, antipyrine has been largely used hypodermically as an analgesic and anodyne, in place of morphine, or where this agent was contra-indicated.]

APOCODEINA AND APONARCEINA.

Apocodeine and Aponarceine (Salts of).

Hydrochlorate of apocodeine (apocodeine differs from codeine in having one equivalent less of water) is soluble in water, uncrystallizable and precipitable by excess of acid. [$C_{18}H_{19}NO_2$, a product of the action of chloride of zinc on codeine. It is amorphous and has emetic properties. "Sydenham Society's Lexicon."—*Trans.*]

Hydrochlorate of apocodeine, .	3 grains
Distilled water, . . .	up to 224 minims.

Sixteen to twenty-four minims = $\frac{1}{8}$ to $\frac{1}{3}$ of a grain. The emetic effect is produced in a few minutes and without fatigue to the patient (Dujardin-Beaumetz). The therapeutic properties of apocodeine are the same as those of apomorphine but to a less degree (Dujardin-Beaumetz). The hydrochlorate of aponarceine is an emetic, but is not in use.

APOMORPHINÆ HYDROCHLORAS.

Apomorphine Hydrochlorate.

Apomorphine only differs from morphine in having one equivalent less of water. The hydrochlorate is alone used.

Principal Physiological Effects.—Feeling of weight at the epigastrium; slight headache, acceleration of pulse and respiration, salivation, perspiration, nausea and vomiting. A feeling of comfort rapidly ensues followed by sleep. "Its action is direct on the nerve centre which excites vomiting, and

not, as some allege, reflex, while its elimination is effected through the gastric glands." (David.) Section of the vagi in aminals does not in any way modify the action of apomorphine (Vulpian, Harnack, Riegel, David); paralysis of these nerves, induced by atropine, appears on the other hand to diminish its action (David). A condition of almost complete and prolonged asphyxia has no influence on the activity of apomorphine (David). The hydrochlorate has no effect on the secretion of bile in dogs (David). In some animals it exercises an excitant effect which is peculiar to them. This action is centric. The animals which are thus affected do not possess the power to vomit (hare, guinea-pig, rat), or offer a peculiar resistance to the vomitive effect of apomorphine (Harnack, David). In poisonous doses it produces coma, paralysis, loss of the reflexes, etc. (Kohler, Quel).

Local Effects.—Hypodermic injections of hydrochlorate of apomorphine have never caused any local disturbance; at the most there have only been observed occasionally small subcutaneous indurations which rapidly disappeared. The pain is nil or almost nil.

Doses (*hypodermic only*).—The emetic doses used hypodermically by various authors are $\frac{1}{16}$ of a grain (Sée), $\frac{1}{13}$ of a grain for an adult, $\frac{1}{43}$ of a grain for a child (Pierce); $\frac{1}{11}$ to $\frac{1}{9}$ of a grain (Siebert, Boehm); $\frac{1}{14}$ to $\frac{1}{7}$ of a grain (Harnack); $\frac{1}{8}$ of a grain (Loeb); $\frac{1}{6}$ of a grain for an adult, $\frac{1}{8}$ for a woman and $\frac{1}{12}$ for a child (Bourgeois); $\frac{1}{7}$ of a grain (Routy); $\frac{1}{16}$ of a grain (Prévost, David); $\frac{1}{4}$ of a grain (Carville, Bourneville). [In one case a fifteenth of a grain caused great prostration. *See* New Sydenham Society's Lexicon, *Art.* Apomorphia.—*Trans.*]

Hydrochlorate of apomorphine should only be used with the utmost caution in consequence of the peculiar tendency to syncope and collapse which it induces in some subjects (David). The majority of works on therapeutics, and the formulæ of many authors, give as the emetic dose $\frac{1}{4}$ of a grain and even more (Dujardin-Beaumetz, "Clinical Therapeutics," of to $\frac{1}{3}$). This dose is decidedly dangerous; no emetic has given rise, regard being had to the frequency of its use, to so many cases of collapse and syncope (cases of Riegel and Boehm, Dujardin-Beaumetz, etc.). A dose of $\frac{1}{18}$ of a grain is sufficient for an adult when the preparation is of good quality, and even with

this dose Messrs. Prévost and David have observed an instance of alarming collapse in a woman. Loeb has seen collapse after a dose of $\frac{1}{15}$ of a grain in a child.

As the emetic doses vary according to the nature of the apomorphine employed, it seems advisable, as has been suggested by M. Prévost, to test its physiological action before administering it to the human subject.

Mode of Use and Formulæ.—According to many authors, apomorphine in solution is very unstable; it has therefore been recommended to be dissolved when required for use. Our friend, M. David, in his interesting work,[17] undertaken in conjunction with M. Prévost, of Geneva, from which we have borrowed largely, speaks as follows of hydrochlorate of apomorphine obtained from M. Duvernoy: "It dissolves with difficulty in cold, rapidly in lukewarm water. The solution after the lapse of a few minutes assumes a green tint. This color deepens, but without any impairment of the physiological effects of the solution. Our solutions after a year's use showed no signs of alteration, although we had not adopted any particular precautions. The change of color is alone noticeable. Our oldest solution is of a dirty emerald green, bordering on yellow; it is neutral in reaction and its physiological properties have not altered from the first day down to the present time. The solution which we use is $\frac{1}{15}$ of a grain of hydrochlorate of apomorphine in 16 minims of water."

The strength of solution recommended by different authors varies greatly, but a one-per-cent solution is most generally used, thus:

Hydrochlorate of apomorphine, .	1 part
Distilled water, ...	100 parts.

[Martindale and Westcott give the following formula:

Hydrochlorate of apomorphine, .	2 grains
Camphor water, ...	100 minims.

Dose—2 to 8 minims.—*Trans.*]

Bourgeois made use of dilute alcohol and distilled water as a solvent. Some add occasionally a few drops of hydrochloric acid to clear up concentrated solutions. M. C. Paul uses glycerin as a solvent. A few drops of acetic acid are sometimes added to preserve the solution, as in the following formula:

Hydrochlorate of apomorphine, .	2 grains
Distilled water, ...	220 minims
Acetic acid, ...	3 minims.
	(Kolner, 1882.)

Therapeutic Uses.—Hydrochlorate of apomorphine is prescribed chiefly as an emetic and expectorant (Juraz). Messrs. Riegel and Boehm have strongly recommded its use in children (!). Eichberg (according to Eulenburg) used it with success in an infant 2½ years old suffering from convulsions connected with gastric disturbance; 8 minims of solution (⅛ of a grain in 100 minims) in distilled water; gastric diseases and obstruction (Worms, Vulpian, Bourneville); various forms of poisoning (morphine, chloral, and chloroform excepted); David says: as morphine delays the development of the action of apomorphine, and as chloroform and chloral injected intravenously delay the action until awakening occurs, it would be useless—nay more, dangerous—to administer hydrochlorate of apomorphine in poisoning by morphine, chloral, and chloroform, owing to the time which would be lost, if the poisoning were sufficient to produce anæsthesia and muscular relaxation. In threatened asphyxia, croup (Chouppe) pneumonia, tonsillitis, and broncho-pneumonia (Dujardin-Beaumetz, Jürgensen), laryngitis stridula, foreign bodies in œsophagus (Verger); severe hæmoptysis (Zuber, C. Paul), mania (Marthe), hystero-epilepsy (Challand, Laurencin, Gowers, Sabatowsky), emphysema with bronchitis (Vulpian, Rowty, Worms), angina tonsillaris (Zuber, Vulpian, Rowty), croup and diphtheria (Alvis, Monti), influenza (Bourneville), epilepsy (Riegel, Vallender, who quotes three cases of epilepsy with aura in which subcutaneous injections of apomorphine brought about cessation of the fits).

AQUA DESTILLATA. AQUA.

Distilled and Natural Water.

Distilled water is the vehicle in most general use for the preparation of hypodermic solutions, and it is besides the best in all cases when its use is admissible. It has also been administered hypodermically by itself. Its use was proposed in the treatment of cholera by Cantani in 1865, Michaël in 1879, and M. Beigel, who injected it in considerable quantities in this dis-

ease in 1866. In the last epidemic of cholera at Yport in 1884, M. A. Bottard made use, with varying results, of the following solution:

The white of one egg,	
Carbonate of sodium, . . .	7½ grains
Filtered sea-water, . . .	1600 minims.

Messrs. Bottard, Vallian, and Caron used 5 canulæ at once, injecting 3 or 4 syringefuls of the solution at the same place. The operation was repeated several times daily.

Cantani's formula:

Chloride of sodium, . . .	4 grains
Carbonate of sodium, . . .	3 grains
Distilled water at 95°–98° F., .	1000 minims.

Samuel's formula:

Chloride of sodium, . . .	6 grains
Carbonate of sodium, . . .	1 grain
Tepid water, ...	1000 minims.

A little morphine, opium, or camphorated oil may be added according to necessity (stage of asphyxia or of collapse).

M. Potani in 1869 used it as a substitute for morphine in localized painful affections, neuralgia, hepatic colic, etc. Drs. Pye-Smith, Burney Yeo, and Griffith had previously used subcutaneous injections of water, and Messrs. Aronssohn and A. Denis, in 1868, of tepid water. Since then numerous authors, Messrs. Dieulafoy, Luton, and Laffitte, have often injected it with success.

The water is injected in doses of 16 to 32 minims at once; it causes somewhat sharp pain, but never gives rise to bad after-effects, especially if distilled water has been used.

In pulmonary and laryngeal tuberculosis, bronchitis and pleurisy, M. Landouzy injected subcutaneously a syringeful of distilled water to which he had added a few drops of cherry-laurel water; the injections were more successful the nearer they were made to the regions where patients complained of experiencing painful sensations—such as burning, pricking, and tingling pains. The peri-laryngeal, cervical, subclavicular, intercostal spaces, and parts which were either painful or tender on pressure, were thus injected. As a general rule, paroxysms of cough in phthisical patients were in this way rap-

idly relieved, and the interval between the paroxysms was prolonged.

Is the effect of hypodermic injections of water in relieving pain to be explained by the hypothesis of M. Vulpian,[18] which certainly has the merit of probability, and was suggested to his mind by the efficacy of certain cutaneous irritants in tabetic pains, the hypothesis, namely, of a centrifugal action on the nerve-centres? Possibly this may be the explanation; but, in any case, M. Luton is of opinion that the subcutaneous injection of water produces a minimum of parenchymatous revulsive action (un minimum de révulsion parenchymateuse [The meaning of which phrase cannot be better explained or expressed than by a quotation from Bescherelle and Pons ("Nouveau dictionnaire classique de la langue Française," Paris, 1865) "Revulsion-Action: de détourner la cause d'une maladie vers un autre point."—*Trans.*]); he has obtained successful results from it in certain localized and recent pains, especially in muscular rheumatism, but in old standing and obstinate cases this treatment has been a failure. "This method," he says, "is obviously inferior to treatment by saline water and alcohol, and, above all, by nitrate of silver solution. Its effects, moreover, are of shorter duration."

Dr. Pollak has quoted a case of sciatica which was cured by the hypodermic injection of iced water.[19] M. R. Tripier has used with success hypodermic injections of fresh spring water in phthisical and other forms of vomiting; the injections were made into the epigastric region either before or immediately after food ("Lyon médical," 1881). M. Laffitte attributes the cessation of pain to the compression of the terminal nerve cellules which is caused by the injected fluid. Dr. Edward Warren[20] recommends hypodermic injections of iced water in cases of persistent hyperpyrexia; he found that these injections had an influence on other symptoms besides the temperature. He administered 480 minims by means of multiple injections into various parts of the body, one-half being injected in the morning, the rest in the evening.

M. A. Riva concludes from his experiments on dogs that the peritoneum is very tolerant of injections of water. M. Calvet observed marked diminution in the proportions of albumen after hypodermic injections of sea-water, and by the same method he obtained improvement in troublesome glan-

dular affections occurring in scrofulous children. Sea-water, when filtered, caused no pain, and suppuration but rarely. [My frjend, Dr. Fergus, of Glasgow, drew my attention some years ago to the fact that in many cases acute pain can speedily be relieved by the injection of hot water. The syringe should first be warmed thoroughly, and the temperature of the water should be raised to as high a degree as can be borne without causing actual pain. In one case of colic this method afforded relief from the pain very speedily, but in cases where it was used for the relief of tabetic pains the effect was at the most equivocal.

Water has long been used hypodermically as a substitute for morphine. A list of papers bearing on this subject may be found in Neale's "Digest and Appendix," § 229.4.

Dr. Cameron Macdowall, of the Indian Medical Service, recommends intraperitoneal, in preference to subcutaneous, injections of warm water in cholera ("Lancet," vol. ii., 1883, 658). Dr. Tibaldi published the results of experiments made by him on dogs to test the value of the various plans suggested for the dilution of the blood in cases of cholera. These results, published in the "Gaz. Med. Ital. Lomb.," Nov., 1884, are quoted in the "London Medical Record," vol. xii., p. 511. Dr. Tibaldi places the highest value on intravenous injections, their effects being produced most rapidly and being most enduring. It was found that absorption from the peritoneum was slow, and even after a lapse of thirty hours fluid remained. This method, however, allows of the injection of a large quantity of water, and in this respect is preferable to subcutaneous injections. On the other hand, the hypodermic method is perfectly safe and readily effected. Arguing from analogy, Dr. Tibaldi considers all these plans perfectly safe. These injections are indicated on the appearance of the algid stage. When the symptoms of this stage are slight and there are no grave asphyxic symptoms the hypodermic method is indicated, and the injections should be made into the upper and inner surface of the thigh, the leg near the popliteal space, or the upper third of the arm. When the asphyxic symptoms are urgent, intravenous injection should be practised, the internal saphenous and veins of the forearm being chosen. When for any reason, such as extreme urgency or the difficulty of finding a sufficiently large superficial vein, the intravenous method

is contraindicated, intraperitoneal injection should be practised.—*Trans.*]

AQUA LAURO-CERASI.

CHERRY-LAUREL WATER.

(*See Acidum Hydrocyanicum.*)

AQUÆ DESTILLATÆ AROMATICÆ.

DISTILLED AROMATIC WATERS.

These are employed as vehicles and solvents; they do not give rise to local irritation, provided they have not undergone a process of oxidation. Gubler has recommended distilled *Eucalyptus globulus* water; M. Delioux, of Savignac, peppermint and cinnamon water and M. Patrouillard, distilled elm water.

AQUÆ MINERALES.

MINERAL WATERS.

Various mineral waters, such as those of Bourbonne-les-Bains, Kreuznach, Pougues, and Salins have been suggested for hypodermic transfusion, as well as the bitter water from salt marshes on account of its analogy with blood serum, but none of them, so far as we know, have been employed as yet.

ARBUTINUM.

ARBUTIN.

Arbutin, a glucoside extracted by Lewin, of Berlin, from *Uva Ursi*, is soluble in water.

The leaves of Uva Ursi have for a very long time been used empirically as a diuretic, chiefly in catarrhal affections of the bladder. The active principle is arbutin, which yields by decomposition in the system hydroquinone. [On boiling with dilute sulphuric acid, arbutin is resolved into hydroquinone and glucose. New Sydenham Society's Lexicon.—*Trans.*] The researches of investigators into the action of arbutin are, as yet, contradictory, and fresh experiments are required before expressing an opinion as to the value of this new product.

At any rate, arbutin has been used but seldom hypodermically. The dose is 15 grains and upward.

ARGENTI NITRAS.

Nitrate of Silver.

Injections of nitrate of silver, the use of which in surgery (tumors, etc.) is so well and universally known, especially since the investigations of M. Luton, have also been employed for internal medication. The pain which follows hypodermic injections of nitrate of silver is often very sharp, although it is of short duration. "They are irritating to the degree of almost necessarily producing an abscess at the point of puncture; nevertheless, the silver nitrate limits of itself, in a manner, its own action, by the production of a zone of coagulation which it produces round itself. There is no kind of inflammation more limited; in the centre, a slough and a sero-purulent collection which isolates and eliminates it; at the circumference a ring of induration (Luton)," often of almost cartilaginous consistence. The artificial abscess allows of the escape of serous or purulent fluid, carrying with it a slough of cellular tissue, and leaving a cicatrix. M. Luton made use of two strengths of solution—one a tenth and the other a fifth:

Crystallized nitrate of silver, .	10 grains
Distilled water, . .	up to 50 or 100 minims.

Of this he injected from 4 to 16 minims. A solution of 1 in 5 almost always determines a slough and afterward an abscess; rarely, the slough is not separated, and it remains encysted in the living tissues, like a foreign body. With a solution of 1 in 10, it is to be observed that the irritation decreases the nearer the injection is made to the trunk; thus, when made at the hip there is no certainty of an abscess resulting. M. Luton does not think that there is any advantge gained by using the weaker solutions. M. Ledentu made use of a solution of 1 in 4.

Without referring to the hypodermic use of silver nitrate for surgical purposes, we find that it has been used in this way in cases of neuralgia (Luton, Ruppaner, Bertin and Michalski), rheumatism, gout (Ruppaner), chronic arthritis, tabes dorsalis (Frommhold).

M. Jacobi has suggested the following formula for hypoder mic injections of silver salts in neuroses:

Argenti chloridi, ...	½ grain
Sodii hyposulphitis, ...	3 grains
Aquæ destillatæ, . . .	up to 112 minims.

M

To be kept in a dark bottle. The dose for injection is 1(minims. This solution does not cause any local disturbance. Prof. Eulenburg has recently made use of pyrophosphate o(silver, soluble in 3.85 parts of a one per cent solution of phos phoric acid, and albuminate of silver ($\frac{1}{14}$ to $\frac{1}{7}$ of a grain in 1(minims).

ARSENIUM.

Arsenic, Preparations of.

Principal Physiological Effects.—In small doses.—Sen sation of heat in œsophagus and stomach, increase of appetite increase of organic functions, diminution of urea and carboni(acid, lowering of temperature and pulse.

In Large Doses.—Feeling of constriction of the throat thirst, epigastric pains, nausea, vomiting, colic, diarrhœa, feve(and headache, insomnia.

In Poisonous Doses.—Diarrhœa, with rice-water stools sometimes bloody; cramps and aphonia, pallor of the face; de bility, irregular and rapid pulse, scarcity and suppression o(urine, dyspnœa, cyanosis, unconsciousness, delirium, convul sions, death.

Slow Poisoning.—Cutaneous eruptions (eczematous, scarla tiniform, etc.); conjunctivitis, extreme anæmia, loss of hai(and of nails, inflammation and ulceration of nasal and laryn geal mucous membranes; paralysis, chiefly of the extensors dropsy, cachexia, fatty degeneration of most of the organs.

Elimination is by the bile, urine, and perspiration. Its du ration is very variable. The physiological effects of arseni(are, further than this, but little known.

Local Effects.—Sensation of burning, lasting from 15 t(20 minutes (Eulenburg, Bourneville). Eulenburg and Kobne(have not met with any local accidents. Sometimes painfu indurations are produced, never exceeding a centimetre (0.3

inch) in diameter, accompanied occasionally by slight redness and even by abscess (Bourneville).

Fowler's solution, ...	1 part
Distilled water, ...	2 parts.

Eulenburg, who has recommended this formula, but who actually used a solution of 1 in 4, in doses of 2½ to 5 minims, =4 to 8 minims of Fowler's solution, has obtained good results from it in various forms of tremor (paralysis agitans, etc.); Kobner, in lichen ruber, and in a case of diffuse sarcoma of the skin (child of 8 years); Lesser, in lupus (1885); Soltmann, in chorea, etc., have also used Fowler's solution and distilled water, in equal parts. One of the authors has used, without success, in the clinique of Prof. Charcot, Professor Eulenburg's solution in four women affected with paralysis agitans; the number of injections was from 16 to 25 (from 15 to 40 minims); they were made on each side of the vertebral spinous processes from the nape to the sacral region. The doses injected ranged from 4 to 10 minims of Fowler's solution.

No particular symptom was observed; occasionally the patients complained of nausea. We have used at the Bicêtre, in chronic cases of chorea, not only Eulenburg's formula, but also the following, without meeting with any local accident (induration, puffing, etc.).

Fowler's solution, ...	200 minims
Distilled water,	
Glycerin, ...	of each 100 minims.

A syringe of 20 minims corresponds to 10 minims of Fowler's solution.

Fowler's solution,	
Tincture of iron malate, .	of each 100 minims.

This tincture, used in Germany, is a solution of impure malate of iron in spirit of cinnamon (1 in 10). [It bears the officinal title: *Tinctura Ferri Pomata.*—See also "Nat. Formulary," No. 398.—R.]

Dose, from a few minims to a syringeful ("Practical Formulary of the Vienna Cliniques").

Arsenic acid has been used hypodermically by Tichomirow, in the treatment of psoriasis.

Lipp, quoted by Bartholow, has injected from ¼ to ⅔ of a

grain of arsenious acid. He observed as a consequence of these injections, increase of temperature and of pulse rate, impairment of appetite, diuresis, nervous excitement, vertigo, cephalalgia, cough, conjunctival redness, etc. Despite these effects produced by a dose, in our opinion, much too large, M. Lipp does not the less recommend the use of this agent, because the duration of treatment is lessened, the dose is small, and there is an absence of digestive troubles.

In Italy, Scarenzio, Gamberini, and others employed hypodermically the strong *mineral water* of Levico, containing somewhat less than $\frac{1}{65}$ of a grain per litre (nearly 34 fluid ounces), in a dose of one to two injections of 16 minims *per diem;* they obtained excellent results in many cases of obstinate skin disease, especially in cases of eczema and impetigo.

Messrs. Billroth, Czerny, and Karewsky (1884) obtained good results from the hypodermic use of arsenious acid in the treatment of lymphoma. Radcliffe used undiluted Fowler's solution, but the local irritation produced was so great that it led him to dilute it by one-half (the irritation was then less than a half of what it had been before). M. Bogomolow has injected it in doses of four minims as an antipyretic and antiseptic in remittent fever. Bartholow recommends, without appearing to have used it, solution of arseniate of sodium, in doses of 5 to 15 minims every second day.

Arseniate of sodium (crystals),	$\frac{1}{2}$ to 1 grain
Distilled water, . . .	up to 112 minims.

(To be injected in progressive doses beginning with a quarter of a syringeful = 4 minims.) José Ramon, of Torres, and Martinez ("La Crónica Medica," Nov., 1883) used this solution in psoriasis.

Therapeutics.—Puerperal fever (Lehmann, of Copenhagen), without success; chorea (Radcliffe, 1865, 2 cases successfully; Perroud, Hammond, Lewis Smith, etc.); cholera, algid state (v. Grafe); various kinds of tremor (Eulenburg); paralysis agitans (Eulenburg, Bourneville); psoriasis (Lewin, Lipp, Tichomirow); lichen ruber (Köbner); chronic eczema (Lipp); neuralgia, epilepsy, and various nervous diseases (Radcliffe); psychoses (Tebaldi).

ASPIDOSPERMINA.

Aspidospermine.

This principle, which is slightly soluble in water, insoluble in glycerin, soluble in alcohol and ether and in essential and fixed oils, is obtained from the bark of *Aspidosperma Quebracho* (Apocynaceæ), a tree orignially found in the Argentine Republic, which is regarded in that country as a febrifuge. It was, we believe, first employed in Europe by Penzold, of Erlangen, who found it had a peculiar action in cases of dyspnœa.

According to M. Burgos, powder of white Quebracho possesses the physical and organic properties of cinchona powder; it is an antiseptic. The decoction is used as a tonic and febrifuge. The phenomena observed after its administration were decreased frequency of the pulse and respirations (Berthold, Picot, Berger, Laquer). Its continued use brought on headache, vertigo, mental hebetude, and profuse salivation (Laquer, Berger). This bark contains abundant tannin and several proximate principles, among them aspidospermine (a very feeble base), and an alkaloid, quebrachine, the latter analogous in action to curare. According to M. Closson, "paralysis of the limbs in animals which survive in poisoning by aspidospermine would be due to an action of the poison on the nervous reflex centres in the spinal cord, the excitability of which is lost before the peripheral nerves, motor and sensory, and the muscles have been attacked by the poison." But with sufficient doses of aspidospermine, the peripheral nerves are first paralyzed, then the muscles lose their sensibility to stimuli to an equal extent.

The sulphate and hydrochlorate are readily soluble, and their solutions are intensely bitter. [Aspidospermine does *not* neutralize acids. But it forms with them, nevertheless, amorphous salts, which are nearly all quite soluble in water and alcohol.—R.] The hydrochlorate has been used by Penzoldt and Maragliano. The latter exhibited quebrachine or aspidospermine in asthma, in doses of ¾ to 1½ gr., both hypodermically and by internal administration.

Sulphate of aspidospermine, . .	5 grains
Distilled water, . . .	up to 112 minims.

Aspidospermine in subcutaneous injections is recommended

by Eulenburg in the "Medicinal-Kalender und Recept-Taschenbuch für die Aerzte des deutschen Reiches," 1883.

Messrs. Huchard and Eloy[21] have made a considerable number of experiments with the principles discovered in quebracho bark by M. Hesse (aspidospermine, aspidospermatine, aspidosamine, quebrachine, hypoquebrachine), quebrachamine excepted, the existence of which is doubtful. These experiments have chiefly had reference to the influence of the alkaloids on the temperature; their antipyretic action is well marked, but uncertain in different cases. They can be classed as antipyretics in the following order:—lactate of aspidospermatine, hydrochlorate of aspidospermine, sulphate of hypoquebrachine [?], lactate of quebrachine. Most of these alkaloids caused arrest of blood changes.

These observers exhibited hydrochlorate of aspidospermine hypodermically in doses of 1½ to 3 grains. In typhoid fever they obtained a reduction of temperature when quinine had failed. In the hectic stage of phthisis the results were as uncertain as with sulphate of quinine.

Aspidospermine, ...	6 grains
Sulphuric acid, ...	a sufficiency
Distilled water, . . .	up to 112 minims.

Sixteen minims = ⅘ of a grain of the drug and upward.

Therapeutic Uses.—Aspidospermine and its salts appear to be especially useful in dyspnœa, no matter what its cause may be (Penzoldt, Berthold, Picot, Skoda, Krauth, etc.).

[The statement that quebracho and its preparations may be used in all forms of dyspnœa, must be accepted with caution. It has been used with success in dyspnœa depending on various forms of cardiac disease, *e.g.*, hypertrophy, aortic incompetence, etc. (see "Medical Record," xii., 71). From the experiments of Harnack and Hoffmann, quoted by Dr. Junker in the "Medical Record," xiii., p. 184, it appears that "the greatest therapeutic value of quebracho bark consists in its property of reducing the irritability of the respiratory centre. It will prove beneficial in cases of dyspnœa not depending on impeded aëration, *i.e.*, on insufficient oxidation of the blood in the lungs, and not being a mere compensatory symptom; namely, in dyspnœa in consequence of disorders of circulation and of diseases of the heart. In other cases, in which the dyspnœa con-

stitutes a purely compensatory manifestation, any attempt at lessening the irritability of the respiratory centres may, under certain circumstances, be fraught with danger, although this remedy may even then occasionally assist in relieving this distressing symptom. Aspidosamine is an emetic, is more energetic than apomorphine, but does not act in the same way on the brain respiratory centres.—*Trans.*]

ATROPINA.

ATROPINE. SULPHATE AND VALERIANATE OF ATROPINE. EXTRACT AND TINCTURE OF BELLADONNA.

Principal Physiological Effects.—In small doses, dryness of the mouth and throat, dilatation of the pupils; in larger doses difficulty of speech and deglutition, facial anæsthesia, blindness, cephalalgia, vertigo, delirium (merry or sad), hallucinations, nausea, slowing, then acceleration, of pulse, scarlatiniform redness of the skin, œdema; in poisonous doses, we find besides, aphonia, muscular spasms, collapse, coldness of the surface, and finally death with arrest of the heart in diastole. Symptoms of poisoning appear in a few minutes (2 to 10). Elimination is effected rapidly by the kidneys, especially in the herbivora.

Local Effects.—No accident is likely to occur provided the solution used is perfectly pure, contains neither acid nor alcohol, and is freshly prepared.

Sulphate of atropine,	1 grain
Distilled water,	up to 1120 minims.

Sixteen minims of this solution contain $\frac{1}{70}$ of a grain of atropine sulphate. It is wise to begin with a small dose, say $\frac{1}{140}$ and rarely to exceed $\frac{1}{35}$ of a grain. In the following formulæ, morphine combined with sulphate of atropine, permits us to obtain all the good effects of these two drugs, especially in the treatment of pain and insomnia, and to increase the dose with safety. The following formula is that of Dujardin-Beaumetz:

Hydrochlorate of morphine,	1 grain
Sulphate of atropine,	$\frac{1}{10}$ grain
Cherry-laurel water,	up to 224 minims.

Sixteen minims of this solution contain $\frac{1}{14}$ of a grain of

morphine, and $\frac{1}{110}$ of a grain of atropine. M. N. Guéneau de Mussy makes use of the following solution:

Hydrochlorate of morphine, . .	5 grains
Sulphate of atropine, . . .	$\frac{1}{10}$ grain
Distilled water, . . .	up to 112 minims.

Sixteen minims contain $\frac{1}{10}$ of a grain of sulphate of atropine, and $\frac{1}{3}$ of a grain of the morphine salt. It is wise to begin with two to four minims. The combination of morphine with atropine has long been extolled by various authors, including Brown-Séquard (1860), Gross, Harley, Lazzati, Fränkel, Lubanski, Fourcault, Ollivier, Prévost, etc. Atropine in combination with morphine has, moreover, been praised and used with good results by Messrs. Aubert, Gayet, and L. Tripier before the days of surgical anæsthesia. Its use previous to anæsthetizing obviates the danger of syncope and secondary inconveniences, such as vomiting. [Dr. Crombie ("Practitioner," Dec., 1881) recommends the subcutaneous injection of morphine after beginning the chloroformization. See also a note on this subject by the translator ("Lancet," vol. i., 1882, p. 1031). It is imperatively necessary to examine the urine before adopting this method, because if it is resorted to in *Bright's disease* two dangers may be encountered, viz., an increased risk of chloroform asphyxia and of uræmia.—*Trans.*] The formula should be such as that of Dujardin-Beaumetz, but the doses of atropine and morphine are to be doubled. Sixteen to twenty-four minims of this solution should be injected 20 to 25 minutes before administering the chloroform.

Some authors (Scholz, Sœmann, Timermans, etc.), make use of valerianate of atropine hypodermically; Tichborne (1879) recommended salicylate of atropine. Extract and tincture of belladonna have also been administered hypodermically, but abscess has been met with after their use.

Therapeutic Uses.—The salts of atropine are chiefly indicated in neuralgia, asthma [but not in asthma when there is dryness of the tongue and mucous membranes generally, with absence of bronchial secretion. If employed in such cases it might give rise to most alarming symptoms (see "Dobell on Asthma," 1886, and "Brunton's Pharmacology," p. 215.—*Trans.*], nocturnal incontinence of urine, constipation, chorea, poisoning by fungi, intestinal obstruction, vaginismus, tetanus,

epilepsy, phthisical sweats, vomiting (of pregnancy, hysteria, etc.); but atropine is of marked service as an anti-sudorific, as antisialagogue, and for the relief of pain. Atropine has besides been used hypodermically as a hæmostatic, M. Tacke attributing to it a much more certain action than to ergot of rye.

Antagonisms.—The experiments of M. J. L. Prévost have shown a mutual antagonism between atropine and muscarine, but he thinks the antagonism between these two substances has not been conclusively proved. An antagonism between calabar bean, physostigmine (Bourneville, Frazer), and pilocarpine (Langley, Luchsinger, Straus), on the one part, and atropine on the other is generally admitted. As for the antagonism between morphine and atropine, it has not yet been adequately proved.

[See an important paper by Dr. Talfourd Jones in the "Brit. Med. Jour.," 1885, vol. ii., p. 581, on hypodermic medication. The preparation of morphine which he recommends for hypodermic use possesses many advantages. It is readily prepared, inexpensive, and keeps well. The mode of preparation is as follows: half fill an ounce stoppered bottle with ordinary water; put into the bottle 40 grains of acetate of morphine, and drop into it 4 minims of B. [or U. S.] P. acetic acid. Then fill the bottle with water, and a clear, pale solution will be obtained of the same strength as the officinal [B.P.] preparation. The same authority recommends an atropo-morphine solution; made by the addition of two grains of atropine sulphate to the ounce of morphine solution. Twelve minims = 1 grain of morphine, and $\frac{1}{120}$ of a grain of atropine. Dr. Talfourd Jones came to the following conclusions as to the use of atropo-morphine: "(1) Fairly small and moderate doses of atropine slightly increase the hypnotic properties of morphine. (2) Atropine in medicinal doses increases the anodyne properties of morphine and this increased anodynia is more marked in local than in distant injections. (3) Atropine in moderate doses counteracts the depressive action of morphine on the heart, and lessens the tendency to sickness, giddiness and faintness; and, by its influence on the circulation and on the skin, it also tends to prevent the clammy sweat, the pallor, and the coldness that morphine not infrequently induces. (4) In small doses it does not influence, to any appreciable degree, the action of morphine on the respiration; but when given in fair medicinal

doses, and *à fortiori*, in larger doses, it increases the number of respirations per minute, and augments their depth."—*Trans.*]

AURI CHLORIDUM.

Chloride of Gold.

We borrow from the work of M. S. Badia the following formula:

Chloride of gold, ...	1 grain
Distilled water, ...	560 minims.
	(*Letamendi.*)

Dose, 16 minims (= $\frac{1}{35}$ of a grain). This solution has been recommended in the treatment of certain syphilitic symptoms. Chloride of gold has also been used successfully by M. Moricourt in hysterical anæsthesia in a solution of 1 part in 500 or 1 in 1000. See also under *Hydrargyrum*.

BELLADONNA.

(*See Atropina.*)

BROMUM.

Bromine.

Soluble in 30 parts of water, also in alcohol, ether, carbon bisulphide, chloroform, glycerin. Bromine has scarcely been used hypodermically except by Goldsmith (1863) in cases of hospital gangrene, who injected one-drop doses in the immediate neighborhood of the wound. After 48 hours the wound had lost its characteristic appearance. Fronmüller has used tannin and iodide of potassium by hypodermic injection in these cases.

CAFFEINA.

Caffeine and its Salts.

Caffeine is soluble in 80 parts of water, and in 50 parts of alcohol.

The salts of caffeine are very unstable. Caffeine in combination with certain sodium salts is readily soluble; these double salts are soluble in 2 parts of boiling water, and remain in solution after cooling.

Principal Physiological Effects.— In small doses (1½ *grains*): increase of functional activity of the brain without any kind of trouble; increase of force of circulation and of vascular tension. *In doses of* 6 *to* 16 *grains*, by subcutaneous injection, in a healthy man: moderate slowing of cardiac contractions, increased fulness and tension of the pulse (Riegel, 1884). *In large doses:* increase or diminution of pulse rate, lowering of blood pressure, elevation of temperature (Binz), headache, tremor of the hands, nausea, vomiting, drowsiness, tinnitus aurium, muscæ volitantes, priapism, frequent desire to micturate, hallucinations, vertigo, acceleration then diminution of the respirations. Increase of reflex excitability. *Poisonous doses* in animals induce general paralysis, arrest of the heart in diastole, death. Disappearance of grave toxic phenomena, when it takes place, does so rapidly.

Elimination takes place by the urine without modification, and by the bile (Strauch). The sulphate, hydrochlorate and hydrobromate split up into the base and acid when brought in contact with water; the citrate is merely a mixture of caffeine and citric acid [the citrate of the Brit. Pharm. containing equal parts, by weight, of each constituent.—R.], though Lloyd, in 1881 obtained a definite combination of these two substances.

Local Effects.—The solution of Pletzer causes sharp pain. Most of the solutions produce a sense of burning due to the addition of acid or alcohol.

Caffeine, ...	1½ grains
Alcohol, ...	6 minims
Distilled water, . . .	up to 96 minims.
Caffeine, ...	18 grains
Acetic acid (strong), . . .	40 minims
Distilled water, . . .	up to 864 minims.

(*Pletzer.*)

Pure caffeine (citrate or hydro-bromate of caffeine), . . .	1 grain
Alcohol, ...	up to 56 minims
or Distilled water, . . .	up to 112 minims.

For stronger solutions it is necessary to add a sufficiency of sulphuric or hydrochloric acid; sixteen to forty-eight minims of the *aqueous* solution are equivalent to ¼ to ¾ grain of caffeine (Eulenburg).

Pure caffeine,	1 grain
Distilled water,	20 minims
Alcohol,	up to 40 minims.

(*Eulenburg.*)

Citrate of caffeine,	1 grain
Glycerin,	up to 32 minims.

(*Lorent.*)

Citrate of caffeine,	1 grain
Glycerin,	32 minims
Distilled water,	up to 64 minims.

(*Erlenmeyer.*)

Caffeine,	6 grains
Salicylate of sodium,	4½ grains
Distilled water,	up to 16 minims.

Dissolve with the aid of heat. Sixteen minims contain 6 grains of caffeine.

(*Tanret* and *Dujardin-Beaumetz.*)

This last formula as well as the following will not cause any local accident or pain. It has been used with benefit by Messrs. Huchard and Lermoyez in the treatment of cholera in doses of 3 grains to 4½ grains of caffeine every two hours.

Caffeine,	50 grains
Benzoate of sodium,	59 grains
Distilled water,	up to 224 minims.

Sixteen minims contain 3½ grains of caffeine.

Caffeine,	25 grains
Cinnamate of sodium,	20 grains
Distilled water,	up to 112 minims.

Sixteen minims contain 3½ grains of caffeine.

[Injectio Caffeinæ Hypodermica.

Caffeine,	20 grains
Salicylate of sodium,	17½ grains
Distilled water	to 1 drachm.

Dose.—1 to 6 minims; contains 1 grain in 3 minims. Particularly recommended for alcoholic and morphine intoxication, also for hemicrania (Martindale and Wescott).—*Trans.*]

Garrison injected a strong infusion of coffee in a case of

morphine poisoning. M. Pallen has injected with success liquid extract of coffee in two cases of acute morphinism.

Therapeutic Uses.—Neuralgia (Eulenburg, Anstie, Pletzer); migraine (Lorent, Eulenburg); insomnia in chronic alcoholism without delirium tremens (Anstie); melancholia, hysteria, cholera (Oser); strangulated hernia (Guzman); heart disease (indications for use same as for digitalis; Riegel). It is well to begin with small doses and, if necessary, to increase them rapidly. Its greatest effect is obtained by small doses frequently repeated. It acts more rapidly than digitalis without producing cumulative effects (Riegel).

Caffeine and its salts have been strongly commended as diuretics; daily doses of 7 to 12 grains of the citrate and hydrobromate induced such abundant diuresis that general œdema disappeared in a few days (Gubler). The older formulæ presented this inconvenience that it was necessary to make many injections to attain these doses. Its constant use not inducing cumulative effects permits of its being administered for whole months (Gubler). According to Riegel, who used it in 8 cases of pleurisy and 4 of nephritis, caffeine appeared to be inferior in its action to other diuretics.

Messrs. Nothnagel and Rossbach find that a dose of 4½ grains of caffeine produces no appreciable effect in man. M. Zuelzer condemns the use of caffeine as an excitant, on account of its insufficiency in small, and the cardiac irregularities caused by large, doses.

[Caffeine has been recommended in the treatment of asthma by Thorowgood. (See Neale's "Digest," 399, 5, and the "Lancet," 1879, vol. i., p. 220. Its action on the temperature is the reverse of that of quinine. "Medical Times and Gazette," 1878, vol. ii., p. 604.—*Trans.*]

CALABARINA.

CALABARINE.

(*See under Physostigmina.*)

CAMPHORA.

CAMPHOR.

Soluble in alcohol, ether, the volatile and fixed oils, and in acetic acid. It is a feeble antiseptic. [Koch's experiments

show that in its action on the development and growth of anthrax bacilli camphor is nearly of the same power as carbolic acid; it hinders in the proportion of 1 to 2500, and prevents their development in the proportion of 1 to 1500. "Brunton's Pharmacol.," p. 77.—*Trans.*]

Principal Physiological Effects.—Slowing and reduction in force of the pulse (Pirogoff), increase in blood pressure in mammalia; reduction of temperature, increase and then decrease of respirations. Cephalalgia, incoherence in talk, hallucinations, generally of a pleasant character (Purkinje), or, from the first, lassitude, mental prostration, yawning, insensibility and loss of consciousness (Alexander, Malewski), convulsions, paralysis of nerves of sensation, of the bladder and rectum, coma and death.

If the dose has been large without being lethal, *e.g.*, from 30 to 80 grains, there is only the stage of exaltation.

Local Effects.—Sharp pain without consecutive local accidents.

Camphor, ...	5 grains
Ether, ...	40 minims
Distilled water, . . .	up to 80 minims.
	(*Eulenburg.*)
Camphor, ...	5 grains
Oil of sweet almonds, . .	up to 112 minims.

(Dupuy, Binz, Zeulzer, and "Pharmacopœia of Vienna Clinique.")

Luton has used the camphorated brandy of the Codex. Eulenburg praises camphorated brandy in doses of 16 to 32 minims, equivalent to 1½ to 3 grains of camphor, and Jürgensen recommends camphorated oil in acute anæmia.

Therapeutic Uses.—Like the preparations of ammonia, camphor is chiefly indicated in adynamia with extreme prostration.

CAMPHORA MONOBROMATA.

Monobromated Camphor.

Sparingly soluble in water, soluble in alcohol, carbon bisulphide, fixed and volatile oils. [Medical writers sometimes call this substance "bromide of camphor," "monobromide of cam-

phor." But these terms denote an entirely different chemical compound, and cannot therefore be used as synonyms of "monobromated camphor."—R.]

Principal Physiological Effects.—Diminution in number of heart beats and of respiratory movements; lowering of temperature, drowsiness. Linhart, Berger, and others deny, wrongly as we think, that monobromated camphor has any hypnotic action. M. Linhart regards it as an excitant of the nervous system. Clonic convulsions and tremors of the limbs (attributed by Lawson to lowering of the animal temperature). The prolonged use of monobromated camphor produces emaciation and abolition of the pharyngeal reflexes (Petrovitz); it does not appear that habituation to this drug can be established. Elimination is by the kidneys (Pathault, Rabuteau).

Local effects are almost nil.

Monobromated camphor, . .	3 grains
Alcohol, ...	26 minims
Glycerin, ...	up to 48 minims.

(*Bourneville.*)

The large proportion of alcohol and the viscosity of this solution have led to its condemnation by several authors. By combining monobromated camphor with other vehicles, or, perhaps, even by other proportions of the above, it may be possible to obtain a solution free from this objection.

Doses—1¾ to 4½ grains according to Hammond; from 7¾ to 36 and 62 grains.

[This dose is much too large. Bartholow recommends it in 5-grain doses for whooping cough in children. No English authority, so far as I know, states the dose at more than 10 grains.—*Trans.*]

M. Valenti y Vivo, arguing from some experiments made on dogs, alleges that there is an antagonism between strychnine and monobromated camphor.

Hypodermic injections of this substance have only been employed by one of the authors, and that very exceptionally. The necessity of multiplying punctures to attain to a sufficient dose, the insolubility of monobromated camphor in water, and the nature of the vehicles which can effect solution will always be objections to its general use.

CANNABIS INDICÆ TINCTURA.

Tincture of Indian Hemp.

Principal Physiological Effects.—Sense of warmth, tingling and pricking, weight of head, tinnitus aurium, oppression, uneasiness, constriction of the throat, dryness of the mouth, nausea, vomiting, diarrhœa. These symptoms are not always observed. [M. Villard has neither observed constipation nor diarrhœa; we have, however, observed this latter symptom, simultaneously with vomiting, in one of our friends.]

In Larger Doses.—Indian hemp is a powerful nervous excitant, there is very great activity of the intellectual faculties, mirthful and sometimes furious delirium, sense of physical and moral well-being, and of lightness, illusions and hallucinations, chiefly visual, increased acuteness of hearing, the movements of locomotion are spasmodic or incoördinated, sleep sometimes disturbed by nightmares.

In Poisonous Doses.—Stupor, coma allied to that of narcotism, anæsthesia and analgesia; rarely there is a manifestation of cataleptic phenomena, lassitude, cephalalgia. The opinions of authors are contradictory as to the effect of cannabis indica on the circulation and temperature. The bronchial, urinary, and sweat secretions are increased, the salivary is diminished. Indian hemp is an aphrodisiac in small, and an anaphrodisiac in large doses; it causes uterine contractions.

Chronic Poisoning.—Physical and mental enfeeblement, listlessness and melancholia, very marked emaciation, stiffness and sometimes tremblings of the limbs, slowness of movements.[22]

Hunter was the first to use injections of Indian hemp; according to Tamhayn he also used it subcutaneously in several cases of tetanus. In one case of chronic miliary tuberculosis, where the prolonged use of morphine had been productive of no result, Prof. Eulenburg obtained by injections of tincture of cannabis, calmer sleep, and a perceptible diminution of cough and pain. He made use of a solution of equal parts of the tincture and distilled water in doses of 10 to 15 drops. From this dose no unpleasant symptoms were observed. Cannabis indica is scarcely ever used now as a hypnotic; but M. Fronmüller uses the tannate of cannabin for this purpose.

Tincture of cannabis indica,
Distilled water, ... equal parts.

From 2 to 5 minims. This solution readily produced abscess.

[It is to be observed that the tincture of cannabis indica made according to the French [or the U. S.] Pharmacopœia is not identical with that of the "British Pharmacopœia, the latter being made by solution of the extract in spirit, the former from the leaves. Dr. Strange, of Worcester, has obtained good results from the use of cannabis indica in the early stages of mania with delusions. Fronmüller has obtained excellent results from the use of Merck's cannabin tannate [made by a process which has not been published. The preparation consists chiefly of the glucoside cannabin, combined with tannic acid.—R.] in cases of nervous insomnia.[23]—*Trans.*]

CANTHARIDIS TINCTURA. CANTHARIDINUM.

Tincture of Cantharides. Cantharidin.

Cantharidin, the vesicating principle of cantharides, is almost insoluble in water and cold alcohol, but readily soluble in boiling alcohol and in ether, chloroform, alkalies and fixed oils.

In a moderately large dose, or slightly under one grain, cantharides powder induces intense vesical tenesmus, gives rise to a sense of tickling of the glans penis, and burning heat in the renal and vesical regions.

In very large doses (16 grains and upward), besides frequent calls to urinate, it leads to ischuria and anuria, albuminuria, painful erections (according to Schroff the action on the sexual organs is due entirely to the essential oil of cantharides), gastro-enteritis, considerable acceleration of pulse and respiration, tinglings, narcotism, dyspnœa, paralysis of the respiratory centre, and general convulsions. Cantharidin is eliminated by all the fluids of the body, but it manifests its action on the surfaces only by acidity of the secretion. It circulates in the blood current in the condition of an alkaline cantharidate, under which form it loses its irritant action (Centisson). The lethal dose of cantharides powder is about 30 grains (Orfila, Schroff); the fatal dose of cantharidin is 100

times less. Tincture of cantharides has been used by Ruppaner in doses of 25 drops (!) in a case of sciatica; the injection was made in the neighborhood of the great trochanter. It was followed by violent pain and the sciatica was relieved, but four days afterward an abscess formed which discharged naturally. In this case the remission was longer than that obtained by opiates and atropine. Luton, after a dose of 20 minims only, observed redness and slight induration.

Cantharidin, ...	1 grain
Chloroform, ...	up to 112 minims.

Dose.—One-fourteenth to one-seventh of a minim = $\frac{1}{1400}$ to $\frac{1}{700}$ of a grain of cantharidin without producing local vesication. Used in the local treatment of pain (Laboulbène; account must be taken here of the action of the chloroform), and in the treatment of chronic nephritis (Laboulbène, Quinquaud).

CAYAPONINUM.

Cayaponin.

A neutral principle obtained from the *Cayaponia globulosa* (Cucurbitaceæ); a drastic purgative much used in veterinary medicine in Brazil. In a one-per-cent solution administered by the mouth, a few drops are sufficient to produce in a short time copious stools without colic. Gubler injected $\frac{1}{12}$ of a grain in one-per-cent solution, without producing purgation, in a case of lead poisoning; at the moment of injection nothing abnormal was observed, but afterward a large painful tumor formed, an œdematous thickening with large ecchymosed aureola surrounding the puncture; the skin presented a slight rose tint. From the centre of the tumor, which persisted for seventeen days, there radiated branching nodosities.

CEDRINUM.

Cedrin.

A crystallizable principle readily soluble in water, obtained by M. Tanret from the seeds of *Simaba Cedron* (Simarubaceæ), a tree growing in Columbia and Costa Rica. In its native country the cedron is in repute in intermittent fevers, serpents' bites, and rabies. It is possessed of tonic properties,

and has also been used in chronic diarrhœa, septicæmia, gout, neuralgia, intestinal worms, and also to arouse uterine contractions. In a dose of $\frac{1}{16}$ of a grain injected hypodermically cedrin produced vertigo in an adult. Its febrifuge virtues are indisputable (Restrepo). Cedrin has been injected hypodermically by M. Restrepo (Dr. Dujardin-Beaumetz's clinique) with comparative success in ague.

CHLORAL HYDRAS.

Hydrate of Chloral.

Physiological Effects.—Feeling of lassitude, irresistible drowsiness, sleep, sometimes preceded by a stage of excitement, especially in drunkards, slowing of the pulse and of respiration and pupillary contraction; preservation of sensibility and reflex excitability, which disappear, however, after large doses; lowering of the temperature. Death by arrest of respiration and sometimes of the heart in diastole. The action of chloral is not due, as has been supposed, to decomposition in the economy into chloroform and an alkaline formate. Moreover, the physiological actions of chloral and chloroform are different. The surface of a wound painted with a 15-per-cent solution becomes covered by a thin slough. In *chronic chloralism*, cutaneous eruptions, intellectual troubles, marasmus, etc., are produced.

Antagonisms.—Picrotoxin (Crichton Browne); nitrite of amyl (Trafford, Dabury, Bussat). [Electricity, atropine, and strychnine have also been recommended in the treatment of chloral poisoning.—*Trans.*]

Local Effects.—Porta, in 69 injections of chloral, has met with 29 instances of local disturbance (phlegmon, abscess, sloughs, lymphadenitis, lymphangitis). One of the authors has used chloral hypodermically in a certain number of cases; he has observed pain of short duration, and sometimes redness and thickening; moreover he has had occasion to examine the skin in two of his patients; in one he could find no lesion attributable to the chloral, in the other, at the point of puncture he found an ecchymotic patch of 8 to 12 millimetres diameter; at this point the cellular tissue was more than usually adherent. At other points, he observed, besides adhesions

of the cellular tissue, indurations in the form of a nucleus with sanguineous effusion (ecchymoses). Finally, in 3 or 4 places, besides the lesions already described, there were in the centre of the indurations small lenticular abscesses. In this case the cellular tissue was partially infiltrated. May not the lesions found at the autopsy have been due to this cause? Other punctures had left no trace.

Chloral, ...	7 grains
Water, ...	up to 16 minims.
Chloral, ...	2½ grains
Glycerin, ...	up to 16 minims.

(*Dujardin-Beaumetz.*)

Hugel has administered chloral hypodermically, as a hypnotic, in aqueous solution (equal parts, and one of chloral to two of water) without producing narcotism. The same pain was produced at the seat of injection and in the surrounding parts. Five half-per-cent injections caused ulcerations in the parts operated on. Chloral has, moreover, been given in combination with morphine (Vidal, Estachy). (See MORPHINE.)

Therapeutic Uses.—Chloral acts more rapidly and certainly as a hypnotic than morphine without producing the ill-effects of the latter. It is therefore especially indicated in the treatment of insomnia. It has been used in cholera (Higgison and Hall), tetanus (Bourneville), eclampsia (Rückard, Froger, Purefroy), neuralgia (Namias, solution 1 to 2), psychoses (Urtel, aqueous solution, equal parts of chloral and water), poisoning by strychnine (Crothers, Charteris, Faucon, in 1882, solution of 1 to 3, given in doses proportional to the quantity of strychnine absorbed).

Many authors, among others M. Gontier ("Thèse de Paris," an essay of particular interest), condemn subcutaneous injections of chloral on account of its caustic action, of the necessity of multiplying punctures, and, in short, of the local troubles which have been observed so often. M. Vulpian has, in consequence of the result of intravenous injections in dogs, indicated the possibility of producing hæmaturia. In view of its causticity, chloral has the inconvenience of necessitating the use of very dilute solutions.

[Playfair recommends chloral as the remedy *par excellence* in rigid os in the first stage of labor, "especially where rigidity

is associated with spasmodic contraction of the muscular fibres of the cervix." He recommends it more strongly than chloroform in the early stages of dilatation where there are severe inoperative pains, inasmuch as chloral has no tendency to annul uterine contractions. He gives it in 15-grain doses every 20 minutes. It might with advantage be used hypodermically in such cases, and the unpleasant local effects would be minimized, if not entirely obviated, by practising deep intramuscular injection in the gluteal region—see note on Ergotin. —*Trans.*]

CROTON-CHLORAL HYDRAS. CHLORAL BUTYLICUM.

CROTON CHLORAL HYDRATE.—BUTYL CHLORAL (HYDRATE).

Soluble in 20 parts water, more so in glycerin, also in water combined with glycerin, and in alcohol. It is not well adapted for hypodermic administration. Croton chloral is a hypnotic like chloral, from which, however, it differs physiologically and physically. It has been injected under the skin of the gluteal region by Worms in two cases.

Croton chloral, ... 4 grains
Glycerin, ... up to 16 minims.

Sharp pain resulted from the injection but no hypnotism. In one case there was marked swelling with decided redness over an area of 6 centimetres (2.34 inches). In another there was a slough of 2 centimetres diameter (0.78 inch)

Croton chloral, ... 16 grains
Warm glycerin,
Cherry-laurel water, of each,
equal parts up to 352 minims.
(*Léoni.*)

Sixteen minims represent ¾ of a grain of croton-chloral nearly. Most authors have given up injections of croton-chloral on account of its irritant action.

CHLOROFORMUM.

CHLOROFORM

First employed hypodermically by Hunter, who discontinued its use on account of the acute pain and intense inflam-

mation to which it gave rise. It was injected again, chiefly in neuralgia of the trigeminal, by Drs. Bartholow, Weir Mitchell, and Mattison. Dr. Bartholow injected from 10 to 12 minims; great pain was induced but the attacks discontinued. He practised the injections in the upper lip, compressing the point of puncture for some seconds, which prevented any local inflammation and its consequences; he did not then find more than a slight puffing along the track of the needle and a transient hardness of the tissues. After an injection of 15 minims in himself, this author experienced slight pain and local anæsthesia extending from the inguinal region to the foot; this anæsthesia persisted for nearly 3 months.

Dr. Mattison, after an injection of half a drachm of chloroform, noted a sharp pain lasting four minutes, puffiness round the puncture, and narcosis for two hours; the neuralgic attacks recurred. M. Collins injected successfully 30 to 40 minims in cases of old-standing sciatica. M. Cérenville (1876) observed in one of his patients after injections of chloroform, which were not painful (50 minims in posterior portion of middle of thigh), complete anæsthesia of the limb; in another case he observed a painful induration. At the beginning of his experiments M. Cérenville injected a syringeful without inconvenience. Afterward he used small doses with equally good results. In cases of sciatica of long standing, which had resisted every other mode of treatment, he obtained success by this method, but it must be observed that he found it necessary to make a larger number of injections than Collins.

M. Besnier (1878) has praised injections of pure chloroform in doses of 8 to 16 minims in the treatment of all local pains, no matter what their cause may be (neuralgiæ, etc.); he never observed general symptoms, and locally only a slight inflammation. According to him the pain should be easily borne or absolutely nil; the operation, when properly performed, should cause neither induration nor nodosities.

Injections of chloroform have also been recommended by Messrs. Dujardin-Beaumetz, C. Paul, Hamelin, Landouzy and Durau, who record results which are closely analogous to those obtained by M. Besnier. M. Féréol has endeavored, with negative results, to substitute injections of chloroform for injections of morphine in patients suffering from neuralgiæ, cancer, hepatic colic, lumbago, etc. The injection was not more

painful than that of pure water, and never produced any local accident (phlegmon, induration, sloughing). Dr. Dujardin-Beaumetz has stated that since he has used chloroform injections with greater frequency, the sloughs due to these injections have become less and less frequent, and that in fact they are only produced when the injection is badly performed.

M. H. Fournier (clinique of Dr. Dujardin-Beaumetz) has tried hypodermic injections of chloroform in the treatment of insomnia. A dose of one drachm was generally sufficient, but no fixed rules can be laid down, and on one occasion it was necessary to give two drachms. Sleep is not associated with anæsthesia. (Chloroform sleep is accompanied with cerebral anæmia.—Arloing.) These injections do not give rise to symptoms of general excitement, which inhalations of ether and chloroform produce. They are not followed by accidents when they are well performed.

Dr. Doc, of Boston, has used with benefit hypodermic injections of chloroform in herpes zoster. M. G. Guillot, after M. Dop, of Toulouse, has used injections of chloroform in toothache; the injections were made into the gum, and produced no local ill-results. M. Blocq has published a case where submucous injections of chloroform into the gum caused very grave results. According to M. Guillot, however, the accidents observed in this case were probably due to impurity of the chloroform employed.

CHRYSAROBINUM.

Chrysarobin (usually misnamed Chrysophanic Acid).

Extracted from Goa powder, a product of a tree found in Brazil, belonging to the family Leguminosæ. It occurs in the form of minute yellow needle-shaped crystals, and belongs to the group of the phenols. This substance, which is not an acid, but a mixture of various proximate principles, at first only used externally (Balmanno Squire, 1878, etc.), has been administered internally since 1881. It is almost insoluble in water, soluble in hot alcohol (224 parts of alcohol at (186.8° F.), benzol, vinegar, vaseline, acetic acid, and very soluble in alkalies.

Chrysarobin is the principle contained in the Goa powder from which chrysophanic acid is derived by oxidation. These

two bodies differ from one another, but either name is often used to designate the substance under discussion.

Principal Physiological Actions.—Loss of appetite, nausea, vomiting, rigors followed by heat, vertigo, sensation of burning and constriction at epigastrium, diarrhœa; intolerance of the drug in different doses varying with the subject, and according to the degree of habituation. The medium dose is about one-seventh of a grain daily for children, and about half a grain daily for adults (Stocquart).

Local Effects.—Even in very weak doses ($\frac{1}{10}$ grain and under), chrysarobin often causes suppuration, lancinating pains, and swelling.

It was first used hypodermically by Stocquart, of Brussels, and with success in eczema, lichen, prurigo, psoriasis and urticaria. Its action would be more rapid and as effectual administered externally, or internally by the stomach; moreover, the accidents resulting from the use of subcutaneous injections of this drug only permit of recourse being had to it in extreme cases, and in minute doses (to $\frac{1}{600}$ of $\frac{1}{120}$ a grain); it is important also to avoid injections into parts susceptible of injury, *e.g.*, the nape, etc.

Chrysarobin, ...	$\frac{1}{2}$ to 1 grain
Distilled water, . . .	2 oz. 160 minims.

CINCHONIDINA. (*See Quinina.*)

CINCHONINA. (*See Quinina.*)

CINNAMOMUM.

Cinnamon, Distilled Water and Tincture.

Distilled cinnamon water has been proposed as a vehicle for solutions (Delioux of Savignac). Cinnamon possesses all the properties of aromatics; it has the power of exciting uterine contractions. It is often prescribed for chronic diarrhœa. Tincture of cinnamon has been used by Luton as a local stimulant in cancer.

COCAINA.

Cocaine and its Salts.

Extracted for the first time from coca leaves by Gaedcke (1855), by Percy (1857), then by Niemann (1859), this alkaloid

occurs in the form of white colorless needles, of a faintly bitter taste and sparingly soluble in water.

The hydrochlorate of cocaine crystallizes in colorless prisms containing 9.59 per cent of water. It is also obtained in anhydrous crystals, which are to be preferred for medicinal use. It dissolves readily in water, and produces local anæsthesia.

Principal Physiological Effects.—Dilatation of the pupils, by paralysis of the filaments of the great sympathetic (Berthold), elevation of the temperature in small doses, lowering after large and poisonous doses (minimum or maximum of temperature variation one-half to one degree after injection; Nègre), increase in pulse volume, increase in respiratory movements followed by irregularity, lowering, followed quickly by increase, of blood pressure (Laborde). Vertigo after doses of ¼ to 1½ grains (Von Anrep, 1880); experiments made on animals by the subcutaneous and intravenous methods have established the fact that, in large doses, cocaine produces hyperexcitability, epileptiform convulsions (from its action on the brain and spinal cord), general analgesia and mydriasis (Morenoy Maïz, Rondeau and Glay, Laborde, Vulpian). According to M. Berthold, there is similarity of action between cocaine and atropine. Injection into the jugular vein of an animal of about ½ of a grain of hydrochlorate of cocaine produces considerable fall of blood-pressure without a previous rise. Elimination is by the kidneys.

Hydrochlorate of cocaine, . .	4 grains
Distilled water, . . .	up to 112 minims.

(*Croston*, 1884.)

An injection of 4 minims (= ¼ of a grain) at intervals of 3 to 5 minutes round a tumor of the face. The first injection was the only painful one. Operation for removal of the tumor was commenced after the third injection, and completed in about 10 minutes.

Since then many medical men have used solutions of cocaine hypodermically in similar cases, among others Messrs. Hall, Halsted, Ceci (5-per-cent solution, 1885), etc.

According to Dr. Dujardin-Beaumetz, there have been observed after injections of cocaine practised on persons in the erect posture, vertigo, syncope, and sensorial illusions with cerebral excitement.

Messrs. Morselli and Buccola have in the medico-psychological clinique of Turin submitted to systematic treatment (in one case for two months) patients affected with melancholia. The doses injected were from $\frac{1}{32}$ to $\frac{1}{4}$ of a grain of cocaine (pupillary dilatation, though, according to M. Livierato, of Geneva, hypodermic injections do not produce mydriasis, rise of temperature—sometimes from one to two degrees—acceleration of pulse and respiration). They found marked amelioration from this course of treatment.

Hydrochlorate of cocaine, . . . 1 grain
Distilled water, . . . up to 112 minims.
16 minims = $\frac{1}{4}$ of a grain.

(*Nègre.*)

Puncture and injection were alike absolutely painless. After 2 or 3 hours there were observed pain and redness corresponding with a slight puffiness (Nègre), never with abscess or true inflammation.

In 1884 Messrs. Baratoux and Burchard availed themselves of the local action of cocaine (1 in 50, or 1 in 25 solution) to open abscesses and whitlows. Wilson removed a lipoma under the anæsthetic action of cocaine.

The experiments of M. Nègre showed that after hypodermic injections in man, made on the dorsal aspect of the forearm, anæsthesia is constant at the site of puncture, and extends in most cases over an elliptical area of which the puncture forms the upper limit. Anæsthesia lasted about ten minutes, and diminished progressively from above downward, but most notably downward.

Dr. Da Costa had formerly observed, after the hypodermic injection of a few centigrammes, and even of a few milligrammes, of cocaine, diminished sensibility at the point of injection and round about; but he thought that this diminished sensibility was of small importance. He obtained no benefit from subcutaneous injections in the treatment of neuralgia.

M. Frignani has used with benefit in the dysphagia of phthisis solutions of cocaine (9 per cent) hypodermically; 4 injections per diem.

Messrs. Hall, Nash, and Cartwright have used a submucous injection of hydrochlorate of cocaine (20 to 30 per cent solution) for tooth extraction. According to M. Brasseur, hy-

drochlorate of cocaine by submucous injection has at the best given but doubful results in cases of toothache.

Dr. Franchotte made use, on himself and another, of hypodermic injections of cocaine (2 per cent) for migraine. He experienced 5 minutes after the injection of 2 centigrammes ($\frac{3}{7}$ grain) a sense of well-being, and obtained complete relief from the hemicrania, but the migraine recurred, although in a milder form.

Hydrochlorate of cocaine has also been combined with morphine (Rusconi) and bichloride of mercury (Plevani). See also MORPHINA and HYDRARGYRUM.

[Prof. Mosler has obtained excellent results from the use of salicylate of cocaine in the treatment of asthma. He injects $\frac{1}{4}$ of a grain in 5 per cent solution.—*Trans.*]

CODEINA.

CODEINE.

Soluble in 80 parts of water, in alcohol, and in ether. For its physiological effects, see the article MORPHINA.

The hydrochlorate and the phosphate of codeine are alone used.[24]

Hydrochlorate of codeine, . . 1 grain
Distilled water, . . . up to 128 minims.
16 minims = $\frac{1}{8}$ of a grain.

(*Erlenmeyer.*)

Erlenmeyer has used it, without apparent benefit, in neuralgia; Reissner in mental diseases in doses of $\frac{3}{4}$ grain to $1\frac{3}{4}$ grains, and Piedvache has used it with success in two cases of neuralgia in solution of 1 in 20.

Phosphate of codeine is soluble in 4 parts of water, and contains 70 per cent of codeine. This salt should be administered in doses twice as large as those of morphine.

Very exceptionally, there are inflammatory troubles at the point of injection. According to M. Yvon, this salt administered hypodermically in a dose of $1\frac{1}{2}$ grains produced no therapeutic result.

[Codeine has also been used in gastrodynia, cancer, and insomnia. It is very useful in some forms of cough, and particularly so in diabetes. In one case of obstinate bronchial asthma I have found it more effectual than any other drug

in quieting the paroxysms and inducing sound refreshing sleep.—*Trans.*]

COLCHICINA.

Colchicine.

Administered first by Lorent in gout, in doses of $\frac{1}{30}$ of a grain, it produced such painful and inflammatory effects that he discontinued its use. He did not observe any effect on pulse and respiration. M. Heyfelder used it with success in articular rheumatism and various neuralgiæ, among others in sciatica.

Colchicine,	1 grain
Distilled water,	up to 1 ounce, 80 minims

Sixteen minims for one dose = $\frac{1}{30}$ of a grain.

Injection causes a sharp burning pain. In one-third of the cases there were signs of local inflammation.

Colchicine has also been employed in chronic rheumatism, in similar doses, by M. Badia, of Barcelona, and by M. Hirsch in acute articular rheumatism, five drops of a 1 in 10 solution once to thrice daily. The local phenomena were insignificant.

According to M. Laborde crystallized colchicine should be included in the category of those proximate principles which require to be administered by centigrammes and not by milligrammes. In doses of one centigramme ($\frac{1}{7}$ grain) it produces in man nausea and vomiting. [According to recent authorities, *pure* colchicine is a powerful agent, and should be used with great care. It is not unlikely that former experimenters have had an impure substance under their hands, of inferior activity.—R.]

CONDURANGO, DECOCTION OF.

The injection of decoction of condurango is said to have yielded encouraging results in four cases of gastric and œsophageal cancer. It is especially useful in gastric catarrh.

CONIINA. CONIINÆ HYDROBROMAS.

Coniine (Conicine). Hydrobromate of Coniine.

Coniine is a *liquid* alkaloid, insoluble in water, soluble in alcohol and ether.

[By a misconception dating back many years, the name *cicutine*, applied by Polex to the volatile alkaloid obtained from the root of *Cicuta virosa*, has been and is still sometimes regarded as a synonym of *coniine*. In the French and Belgian Pharmacopœias the former name is even the leading title. It should be abandoned.—R.]

Principal Physiological Effects.—These are very variable; dejection, sadness, general tremors, dyspnœa, rapid pulse, increase, then diminution and finally loss, of reflex irritability; slowing of the pulse and respirations; analgesia; paralyzing action on motor nerves, which lose their excitability. M. Tyriakan attributes this action to a species of essential empyreumatic oil, as yet ill-defined, extracted from German coniine by M. Mourrut. [This cannot be the case at present, as the coniine made by the German manufacturing chemists is remarkably pure.—R.] The vagus nerve, which is the first to suffer, is also the first to recover.

Pure coniine has no physiological action on the motor and sensory nerves; it affects motion and sensation only by its action on the nerve centres (Tuloup). Respiration is most rapidly affected, the heart is the last to die; the organs of sense, the digestive and calorific functions are little affected (Tuloup); affections of sight, collapse, and death by asphyxia. The hydrochlorate and hydrobromate of coniine are stable salts. Their action is similar to that of coniine, but more energetic. In short, it is very difficult to estimate the action of coniine and of its salts, because of their instability and irregularity of action.

According to M. Bochefontaine, Conium maculatum contains two active principles, viz., coniine (conicine, "cicutine") paralyzing the central nervous system, and another alkaloid resembling curare. Two hydrobromates are to be distinguished, one of an amber color [?—R.] comporting itself like coniine; the other of a mother-of-pearl tint, acting like curare. It was the latter which M. Prévost used.

The poisonous dose of coniine varies from ¾ of a grain to 8 grains according to the preparation used (Van Hasselt-Heukel); according to Messrs. Tuloup, Bochefontaine and Tyriakan, as much as 7½ to 8 grains may be given in alcoholic solution to dogs without a fatal result.

The hydrobromate of coniine may be prescribed, according

to M. Tyriakan, in a small dose of 1½ grains, which may be repeated several times a day till 15 grains or more have been taken. According to M. Tuloup it is well to begin with 1½ grains of hydrobromate of coniine, to be taken twice in the 24 hours; the dose should not exceed 4 to 4½ grains. Young children have borne doses of ¼ to ½ grain without evil effects—convulsions or diarrhœa—merely apathy and weakness of the limbs.

Elimination is rapidly effected by the skin and lungs. There is possibly a physiological antagonism between strychnine and coniine, but it has not been demonstrated.

[The dose of coniine and its hydrobromate should not exceed ½ to 2 grains. According to Brunton it is useless in tetanus and strychnine poisoning.—*Trans.*]

Local Effects.—In no case was pain or inflammation of the cellular tissue observed (Jousset); on the other hand, Messrs. Tyriakan and Tuloup assert that it is possessed of caustic and irritant properties. The hydrobromate has no local irritant action (Tyriakan).

Coniine, ...	1 grain
Alcohol, ...	90 minims
Distilled water, .	up to 1½ ounces, 48 minims.

Sixteen minims = $\frac{1}{48}$ grain.

Coniine, ...	1 grain
Diluted alcohol, ...	144 minims
Distilled water, . . .	up to 288 minims.

From 4 to 16 minims $\frac{1}{72}$ to $\frac{1}{18}$ of a grain ("Pharmacopœia of the Vienna Hospitals").

Hydrobromate of coniine, . .	1 grain
Alcohol, ...	3 minims
Cherry-laurel water, . .	up to 48 minims.

Sixteen minims of the solution contain ⅓ of a grain of the salt. (*Dujardin-Beaumetz.*)

Hydrobromate of coniine, . .	1 grain
Distilled water, ...	20 minims.

Dose, 1 to 3 minims (*Martindale*).

Therapeutic Uses.—Asthma (Pletzer, D'Heilly), pulmonary emphysema and angina pectoris (Erlenmeyer, Lorent), pneumonia and pleurisy (Lorent), tetanus (Stewart), fever (Wert-

heim), blepharospasm (Eulenburg), whooping cough, bronchitis and spasmodic laryngitis (Méga), tic douloreux (Chaussier, Duméril), chorea (Welch, Harley).

Coniine and its salts have, moreover, been used by Busch as narcotics (aqueous solution of 1 in 480), and they have been praised by Messrs. Tuloup, Tyriakan, and Dujardin-Beaumetz in the treatment of convulsive cough, dyspnœa, laryngismus stridulus, various forms of spasm, tetanus, eclampsia, epilepsy, hysteria, and neuralgia.

[Sir Crichton Browne recommends coniine in acute mania. —*Trans.*]

CONVALLARIA MAJALIS.

Lily of the Valley.

Convallaria majalis, recommended by various authors as a cardiac remedy, has been used hypodermically in a few cases by Dr. Smith Andrew ("Cases Illustrating the Action of Convallaria on the Heart." "Archives of Medicine," VIII., p. 293). [I have not been able to find a reference to this essay in the English journals.—*Trans.*]

CORNUTINUM.

(*See Acidum Sclerotinicum.*)

COTOINUM.

Cotoin.

Cotoin was isolated by J. Jobst, of Stuttgart, in 1875. It is a glucoside extracted from coto bark (obtained from a tree hitherto undetermined); crystallizes in yellow quadratic needles; is fusible at 130° C. (Wurtz); is soluble in boiling water; also in alcohol, ether, benzol, and chloroform; is slightly soluble in cold water, and almost insoluble in petroleum benzin. It has a sharp, biting taste.

According to Pribram it is an antiputrescent and antizymotic, but Albertoni asserts that it only delays fermentation.

Physiological Properties.—In doses of 16 grains it had no poisonous effect on rabbits (Burkart); one and a half to three grains administered to a healthy man (the dose being repeated several times daily) increased the appetite without producing any disorder or constipation. It is insoluble in the gastric

juice, but is soluble in the intestinal fluids; dilates the abdominal vessels (Albertoni); modifies and restores the functional energy of the intestinal epithelium (Albertoni); lowers the temperature (Burkart); has no effect on peristalsis, but is possessed of antisudorific (Fronmüller) and antisialagogue properties (Albertoni). Elimination is effected by the urine; there is diminution of indican (Burkart, Pribram).

Therapeutic Uses.—Cotoin is chiefly useful in the treatment of diarrhœa, except in cases of ulceration of the intestines and in patients suffering from alcoholism and cirrhosis (Burkart, Albertoni, Gielt, Pribram, Petrone).

It has also been recommended in cholera, the night sweats of phthisis (Fronmüller), salivation (Albertoni), etc. Some observers appear to have obtained no result from the exhibition of cotoin (Patella, Cattani, Bergesio, etc.).[25]

Cotoin, ...	4 grains
Acetic ether, ...	up to 16 minims.

Inject a Pravaz syringeful (16 minims) every 15 or 20 minutes, or every hour. The injection must be made deeply.

Messrs. Burkart and Jobst, who, subsequently to Baltz (1878), recommended this solution in cholera, advised that 8 to 16 grains of chloral should be added to diminish the pain. They also say that, according to the gravity of the case, the dose may be increased, as the preparations of coto have no narcotic effect and do not give rise to any trouble.

CREASOTUM.

Creasote.

Creasote was used in 1884 by Rynd as a vehicle for morphine.

Morphine, ...	10 grains
Creasote, ...	1 drachm.

Six drops for one dose in sciatica. He obtained good results from this prescription. Eulenburg in one case of facial neuralgia injected 3 drops of the solution. The injection was extremely painful and produced an elevation of the skin resulting in a yellow pustule which subsided on the second day and was succeeded by sloughing, redness, infiltration, and thickening.

Creasote has recently been injected subcutaneously in the treatment of phthisis by Messrs. du Castel and Maigret (1882 and 1884).

Dried pepsin, ...	10 grains
Creasote (from beech-wood tar), .	3 minims
Glycerin, ...	80 minims
Alcohol, ...	10 minims
Water, ...	up to 112 minims.

The pain produced by this injection may be avoided by adding to the formula $\frac{1}{4}$ to $\frac{1}{2}$ grain of hydrochlorate of morphine. Sixteen minims of the solution contain $\frac{3}{4}$ minim of creasote. Five to six injections daily may be made deeply and, if necessary, into the muscular substance.

CUPRI SULPHAS.

Copper, Sulphate of.

Sulphate of copper has been used, without any effect, as an emetic by Lissauer. He found that the injection caused violent local inflammation and abscess. M. Luton used it to produce suppuration by derivation, but he found it inferior for this purpose to nitrate of silver.

CURARA; CURARINA.

Curare; Curarine.

Curare is soluble in water, and in alcohol and water, but is insoluble in ether. Curarine is deliquescent and readily soluble in alcohol and in water.

Principal Physiological Effects of Curare.—From $\frac{1}{4}$ to $\frac{1}{2}$ grain; congestion of brain, violent, but transient; headache, feeling of fatigue, apathy, increase of salivary, lachrymal, sudoriparous and urinary secretions, glycosuria, pulse of greater force and frequency, more rapid respiration, and increase of temperature.

In doses of $1\frac{1}{2}$ grains; rigors, frequent and feeble heart beats, increase of temperature, increase of secretions, distress, and affections of sight, paralysis of lower limbs, intense headache, no loss of consciousness or sensation, diminution of organic changes.

The paralytic action of curare is at first confined to the extremities of the motor nerves; in very large doses this effect extends to the intra-vascular extremities of the vaso-motor nerves. Death occurs from paralysis of respiration. Elimination is rapidly effected by the kidneys. The physiological effects of curare and curarine are identical, but the latter is the more powerful.

Antidotes.—Ligature above the wound by which the poison has been introduced. Artificial respiration, kept up for 2 or 3 hours.

Dose.—According to Messrs. A. Voisin and H. Liouville the hypodermic dose should begin from $\frac{1}{2}$ to $\frac{3}{4}$ grain. Curarine might in man be injected in doses beginning at $\frac{1}{7}$ grain. Poisonous doses manifest their effects in 3 or 4 minutes; if no effect is noticed after a lapse of half an hour the curare used may be regarded as inert.

The diaphragm being the last muscle the nerve endings of which are attacked by curare, it is easily understood how, when, by degrees, all the other muscles are in a state of relaxation, it may of itself keep up respiration, and consequently maintain life. The *extreme dose* is that which, though producing paralysis of the nerve endings of all the other muscles, still permits the diaphragm to act.

As the greatest uncertainty prevails as to the nature and source of the curare used, it is quite essential to test that which it is proposed to administer. We have therefore to ascertain (1) the genuineness of the curare (2) the degree of its activity. The samples of curare are never alike, the most active only cause death in a rabbit of 4 to 5 pounds in a dose of $\frac{1}{18}$ of a grain; with some samples it would be necessary to give $\frac{2}{7}$, $\frac{1}{2}$, $\frac{3}{4}$ grain to produce the same result. One-fourteenth of a grain of curare being the extreme dose for a rabbit of 5 pounds 7 ounces, an animal of 50 pounds weight would require as the extreme dose about $\frac{3}{4}$ grain; one of over 108 pounds double that dose, and one of 164 pounds and over $2\frac{1}{4}$ grains. The extreme dose is ascertained by injecting in a rabbit increasing doses until a lethal effect is produced, the dose immediately preceding the fatal one being the extreme dose.

Local Effects.—Swelling, pain, local and general rise of temperature, considerable redness, subcutaneous puffing, rosy-white elevation like urticaria (Voisin and Liouville, Du Cazal;

it should be remembered that injections into the skin often produce this result); painful swellings followed by abscess, which persisted several months, from the use of unfiltered solutions.

Point of Injection.—It is always better to inject into a limb, so as not to lose the resource of ligaturing in case of serious accident.

Curare,	1 grain
Distilled water,	56 minims
Glycerin,	up to 112 minims.

(Eulenburg, "Medic. Kalender," 1883.)

Curare,	1 grain
Distilled water,	up to 112 or 56 minims.

Curare,	1 grain
Glycerin,	up to 64 minims.

(*Rosenthal.*)

Curare,	1 grain
Hydrochloric acid,	10 minims
Distilled water,	up to 64 minims.

("Formulary of Vienna Hospital.")

Curare,	5 grains
Distilled water,	up to 30 minims.

(*Jousset.*)

Curare,	5 grains
Hydrochloric acid,	10 minims
Distilled water,	up to 64 minims.

Every fifth day one-third or two-fifths of a Pravaz syringe (5 to 10 min. Kunze, Edelfrei). Du Cazel used an aqueous solution, made by M. Hepp, with the addition of a few drops of alcohol; "it was more a suspension than a solution."

Preyer recommends the salts of curarine, especially the sulphate, in doses of from $\frac{1}{70}$ to $\frac{1}{14}$ grain.

Curarine,	1 grain
Distilled water,	up to 56 grains.

This was the solution which M. Beigel used, but according to M. Sachs, Preyer's curarine did not contain any active principle and was composed chiefly of phosphate of calcium.

Quite recently Dr. G. Lehmann, of Munich,[26] made use of the following solution:

Sulphate of curarine, . . .	1 grain
Cherry-laurel water, . . .	12 minims
Distilled water, . . .	up to 96 minims.

The effects observed in animals after a dose of $\frac{1}{20}$ grain are —paralysis, more or less pronounced, convulsions of the limbs, increased excitability of muscular and cutaneous reflexes, superficial respiration; *in poisonous doses,* forced expiration, progressive enfeeblement of the heart's action, involuntary urination, salivation and lachrymation. In a healthy man after a dose of $\frac{1}{7}$ grain the pulse rose from 74 to 90 beats in the first minute and then sank to the normal rate. After 5 minutes there were occasional disturbances of vision, tendency to vertigo, feeling of oppressed breathing and general debility. The pupils were normal. The symptoms had vanished in two hours. The reflexes were normal, but there was sense of weight and oppression of the head. The same symptoms were observed after doses of $\frac{1}{14}$ grain to $\frac{2}{7}$ grain.

Sulphate of curarine administered internally in doses of $\frac{2}{7}$ to $\frac{4}{7}$ grain produced similar results in from 20 to 30 minutes after its administration. M. Lehmann, who administered sulphate of curarine in cases of maniacal excitement, found no benefit result from its use.

Therapeutic Uses.—Tetanus (Vulpian and Mance, Follin, Gintrac, Richard, Cornaz, Gherini, Lochner, Demme, Neudorfer); epilepsy (Mandl, Benedikt, Voisin and Liouville, Du Cazal, Kunze, Edelfrei, Bourneville and Bricon). We have used at the Bicêtre hypodermic injections of a 2-per-cent aqueous solution of curare in the treatment of epilepsy; we have practised more than 3000 injections, and we have only rarely observed slight local accidents (ecchymoses and indurations), and these of short duration); hydrophobia (Fauvel, 1864, Vulpian, Offenberg); chorea, strychnine poisoning (Richter, Burow, Corona), convulsive tic (Gualla); meningitis (Landerberger). Curarine has only exceptionally been employed, by Busch and Beigel among others. This last observer injected it in a case of epilepsy, without effect, up to a dose of over $\frac{1}{7}$ of a grain.

[According to Waring, "Manual of Practical Therapeutics," 4th edit., 1886, the dose of curarine hypodermically is $\frac{1}{20}$

to $\frac{1}{100}$ of a grain. He says—"that curare controls the spasms of *tetanus* and *hydrophobia* is beyond question, but how far it is really effectual in promoting an actual cure has yet to be shown. The best mode of administration is to inject hypodermically $\frac{1}{10}$ gr. in aqueous (filtered) solution (10 minims of a 1 per cent solution)."—*Trans.*]

DATURINA. EXTRACTUM STRAMONII.

Daturine. Extract of Stramonium.

A basic principle extracted from the leaves and seeds of *Datura Stramonium* (Solanaceæ). [It is not a chemical individual, but consists of atropine (recognized as such by Planta), contaminated with more or less hyoscyamine.—R.] It is sparingly soluble in water (1 in 288), but freely soluble in alcohol, less so in ether.

Chief Physiological Actions.—In small doses ($\frac{1}{10}$ to $\frac{3}{10}$ grain): dilatation of the pupils, dryness of the throat and mouth, dysphagia, intense thirst, slight increase of pulse and respirations, increased blood pressure, increased intestinal contractions, elevation (not constant) of temperature, heaviness of the head, slight excitement with tendency to movements (the legs are unsteady and give way), lassitude, occasional delirium, profound sleep. Variable phenomena, visual troubles (diplopia, etc.), erotic dreams, pollutions (Oulmont and Laurent). Pricking sensations and tremors (Schroff).

A larger dose produces a condition precisely analogous to drunkenness, the visual troubles are more decided, the iris completely invisible (never amblyopia).

In Large Doses.—Dysphagia, dryness and burning of the throat, hoarseness of the voice, sometimes absolute aphonia, rapid respiration which becomes jerky and sighing, rapid cardiac action, fall of temperature and of arterial tension, intestinal paralysis, pallor, chilliness with clammy sweats of the extremities. Sometimes, from the beginning, hallucinations, general convulsions, frequent desire to urinate, with or without priapism, coma, urgent thirst, and headache on awaking. Messrs. Oulmont and Laurent have never seen erythema.

In Very Large Doses.—The phenomena resemble intermittents (M. Laurent after an injection of $\frac{1}{12}$ grain has observed intermittent symptoms persisting for several days),

and there is arrest of the heart beats; peripheral sensibility is only blunted in poisonous doses. Daturine exerts its action especially on the great sympathetic; in small doses it diminishes the capillary circulation—in strong doses it determines vascular paralysis (Oulmont and Laurent).

After death in animals there are found intense injection of the meninges, and frequently hemorrhagic extravasations at the base of the brain—there are no changes at the point of injection.

Elimination is rapid and is chiefly effected by the kidneys (Oulmont and Laurent). Daturine is *antagonized* by physostigmine (Amagat). *Local effects* are nil.

Extract of stramonium, .	1 grain
Distilled water, . . .	up to 64 minims.

Dose.—4 to 12 minims.

(*Lorent.*)

Therapeutic Uses.—Pulmonary emphysema (Lorent), neuralgia (Oulmont and Laurent), tetanus, various forms of tremor (shaking palsy, etc.).

[According to Waring, daturine may be given hypodermically in *acute mania*, in doses of $\frac{1}{120}$ to $\frac{1}{60}$ grain, but it is less useful than atropine or hyoscyamine.—*Trans.*]

DIASTASE.

(*See also Injectiones Nutrientes Hypodermicæ.*)

Soluble in water, insoluble in alcohol. Diastase has been injected by Küssmaul in doses of 1½ to 3 grains, in watery solution, in diabetes mellitus, without diminution of the sugar in the urine (diminution occurred after intravenous injection).

DIGITALINUM. TINCTURA DIGITALIS.

Digitaline. Tincture of Digitalis.

[Digitalin, as usually found in commerce, is a mixture of various neutral principles extracted from digitalis, the activity of which appears to depend upon the proportion of the exceedingly energetic digitoxin contained therein.—R.] It is practically insoluble in water, fairly soluble in ether, freely soluble

in alcohol and in chloroform. The degree of solubility varies with the sample of digitalin.

The composition of samples of commercial digitaline is very various, and it is, moreover, difficult to obtain it in a state of purity; we therefore think it preferable to recommend the use of preparations of the plant.

Digitalin, digitalein, and digitoxin produce effects similar to those produced by digitalis leaves. Digitoxin possesses the most intensely poisonous properties of the three. The products of decomposition, digitaliresin and toxiresin, are convulsants: they have been the subjects of investigation by Dr. Schmiedeberg and our friend Dr. H. Perrier; they are not used. [As commercial "digitalin" is so uncertain in its composition, it ought to be entirely discarded. Or, at all events, the maker's name, or the process by which it is prepared, for instance "Digitaline crystallisée, *Codex*," should be specified.—R.]

Principal Physiological Effects.—Diminution of frequency of the pulse beats with increase of arterial tension, fall of temerature, increased diuresis, diminished perspiration (Gubler).

In Poisonous Doses.—The symptoms are reversed.

Elimination is slow and the effects are cumulative.

Local Effects.—In a case of heart disease with general œdema, ten drops of an alcoholic solution of digitalin (= $\frac{1}{40}$ grain) produced, in addition to sharp pain at the time of injection, a comparatively large slough (Luton). Courvat, in 1871, had already observed the local irritant action of digitalin. The solution of Pletzer is also irritating, but that made use of by Prof. Eulenburg, prepared freshly, has according to him no local irritant action. The injections administered by Gubler do not occasion local accidents, except slight transient pain and burning. M. Guarda, with a solution of $\frac{1}{4}$ grain in 16 minims of water, produced an erysipelatous swelling. Witkowski has observed grave local accidents (phlegmon, etc.). Digitoxin (not in use) causes phlegmons when administered hypodermically, even in extremely small doses.

Digitalin (Merck's), . . .	1 grain
Glycerin, ...	600 minims
Distilled water, . . .	up to 880 minims.

16 minims = $\frac{1}{55}$ grain.

(*Witkowski.*)

Digitalin (Merck's), ... 1 grain
Glycerin, ... 1 minim
Distilled water, . . up to 12 or 24 minims.
(*Otto.*)

[This solution is inconveniently strong; one minim = $\frac{1}{24}$ – $\frac{1}{12}$ grain of digitalin.—*Trans.*]

Francque has used tincture of digitalis, Lorent uses digitalin dissolved in glycerin.

Digitalin, ... 1 grain
Glycerin, ... 12 minims
Distilled water, . . . up to 96 minims.

Four minims of this solution are equivalent to $\frac{1}{12}$ grain of digitalin. (*Pletzer.*)

[I have altered this formula, the quantities given in the French Edition being manifestly erroneous.—*Trans.*]

Fronmüller makes use of an aqueous solution, which must always be shaken before use, and Erlenmeyer of a perfectly clear aqueous solution of 1 in 20.

Digitalin, ... 1 grain
Alcohol, ... 112 minims
Distilled water, . . . up to 224 minims.
4 minims = $\frac{1}{56}$ grain of digitalin.
(*Eulenburg.*)

Digitalin, ... 1 grain
Alcohol (95%), ... 9 fluidrachms
Distilled water, . . . up to 1120 minims.
16 minims = $\frac{1}{70}$ of a grain.
(*Adrian.*)

Pletzer, Fronmüller, Erlenmeyer, Eulenburg, etc., used the digitalin of Walz, which is soluble in 125 parts of cold water, whilst the digitalin of Nativelle is insoluble.

Gubler has used a solution of one in five hundred of Homolle and Quévenne's amorphous digitalin in a mixture of alcohol and water in equal proportions; 16 minims of this solution are equivalent to $\frac{1}{35}$ grain of digitalin.

Homolle and Quévenne's digitalin, 1 grain
Alcohol, ... 280 minims
Distilled water, . . . up to 560 minims.
(*Gubler.*)

Eight minims are equal to $\frac{1}{70}$ grain of digitalin.

Therapeutic Uses.—Heart diseases (Eulenburg, Fronmüller, Guala), mental diseases (Otto).

[The use of digitalis hypodermically is not as a rule desirable. According to Dr. Wood, of Philadelphia, tincture of digitalis causes less irritation when injected subcutaneously and is otherwise preferable.—*Trans.*]

DUBOISINE.

An alkaloid obtained from *Duboisa myoporoides*, a shrub half-way between the Solanaceæ and Scrophulariaceæ (Lanessan); chemically and physiologically identical with hyoscyamine (Ladenburg, Berner), very little soluble in water, freely soluble in alcohol, ether, chloroform, benzol and bisulphide of carbon (Gerrard).

Physiological Actions.—Mydriasis, arrest of sweat secretion, dryness of the throat, hyperæsthesia, quickened pulse, cephalalgia, vertigo. Tetanus in frogs (Sidney Ringer), somnolence, general enfeeblement. According to Dr. Ringer its action is the opposite of that of jaborandi and pilocarpine, and also of muscarine (rapidity of heart beats is diminished by the latter). Binz says: We see that these effects resemble those of atropine, and that it forms with the latter, daturine, hyoscyamine, and hyoscine a sort of ascending series.

Sulphate of duboisine, . . .	1 grain
Distilled water, . .	up to 1 ounce 45 minims.

From one and a half to three minims of the solution contain $\frac{1}{320}$ to $\frac{1}{160}$ grain of salt.

M. Dujardin-Beaumetz has observed some poisonous symptoms with daily doses of $\frac{1}{280}$ to $\frac{1}{140}$ grain in a solution of 1 in 2,000, in the treatment of exophthalmic goître; he therefore recommends a lapse of some days between the injections. Three drops of a one-per-cent solution inserted into the conjunctival cul-de-sac produced symptoms of poisoning.

Therapeutic Uses.—Exophthalmic goître (Dujardin-Beaumetz, Desnos, $\frac{1}{140}$ to $\frac{1}{10}$ grain), night sweats (Blake, $\frac{1}{10}$ grain), asthma (Bancroft).

[Gubler uses this remedy hypodermically in the sweating of phthisis, and also in cases of acute mania.—*Trans.*]

EMETINA.

EMETINE.

Pure emetine, an alkaloid of ipecacuanha, is very sparingly soluble in cold water (1 in 1,000) and in ether, is readily soluble in alcohol, chloroform, carbon bisulphide and fixed and essential oils (Podwyssotzki). The nitrate of emetine is soluble, 1 in 100 parts; the sulphate of emetine is the most soluble salt.

Principal Physiological Effects.—In doses of $\frac{1}{14}$ to $1\frac{1}{2}$ grains, burning taste, salivation, nausea, vomiting, diarrhœa, profuse sweats. During the period of nausea and vomiting, quickening, then slowing, of the heart-beats and of respiratory movements (Ackermann), fall of temperature. According to Messrs. d'Ornellas and Gubler, emetine injected hypodermically produces the emetic effect much more slowly (about 40 minutes) than by the stomach. Vomiting accompanies elimination from the stomach. In frogs there is loss of spinal reflex irritability and paralysis of the peripheral motor nerves and of the muscles (Weyland, Pécholier, Harnack).

In Poisonous Doses.—Extreme muscular debility, collapse and death ($\frac{3}{4}$ grain in a cat, and $1\frac{1}{2}$ to $4\frac{1}{2}$ grains in a dog).

Emetic Doses.—One-fourteenth to two-sevenths of a grain (Nothnagel and Rossbach). According to Gubler, it is necessary to give not less than 3 to $4\frac{1}{2}$ grains to produce the same effects as are obtained by 16 to 24 grains of powdered ipecacuanha. The human subject can tolerate considerable quantities of it, especially if it is injected in the subcutaneous cellular tissue; even to $3\frac{1}{2}$ grains introduced several times. It is possible to obtain no poisonous effect from it—not even any inconvenience. The doses indicated as emetic by the hypodermic method by M. d'Ornellas are, on the other hand, very small, viz., from $\frac{1}{16}$ to $\frac{1}{14}$ grain. Fonssagrives recommends a dose of $1\frac{1}{2}$ grains hypodermically; Dyce Duckworth, $\frac{1}{24}$ grain.

Local Effects.—In the practice of Eulenburg, injection did not appear to induce pain; there remained only at the point of puncture a trifling redness which soon disappeared (the child was suffering from capillary bronchitis and died the following day). Sir Dyce Duckworth found on one occasion slight induration. Applied to the skin emetine produces inflammation and pustules.

Emetine (pure), ...	3 grains
Sulphuric acid, ...	1 minim
Distilled water, ...	up to 48 minims.

One minim = $\frac{1}{16}$ grain.

(*Eulenburg.*)

This author injected this dose several times in a case of acute capillary bronchitis in a child without any effect.

Emetine (pure), ...	1 grain
Distilled water, . .	up to 140 minims.

One-tenth of a syringe or 2 minims ($\frac{1}{70}$ grain) to be injected every five minutes till the desired result is obtained. "Pharmacop. of Vienna Clinics," and "Klin. Recepttaschenbuch." This solution is apt to produce suppuration; it is necessary to acidulate it, to effect solution of the emetine.

ERGOTÆ EXTRACTUM; ERGOTINUM; ERGOTININA.

EXTRACT OF ERGOT; ERGOTINA; ERGOTININE.

The extracts, prepared *in vacuo*, by Grandval of Rheims, and by Berjot, of Caen, the ergotine of Bonjean, of Chambéry (which is an aqueous extract of ergot of rye), the alcoholic extract of Wiggers, the ergotinine of Tanret, the hydroalcoholate of Yvon, as well as the ecboline and ergotine of Wenzel and others are nothing more than mixtures of the soluble principles contained in ergot. (See the section on SCLEROTINIC ACID.)

We think that preference should be given, for hypodermic purposes, to the ergotins of Bonjean and especially to that of Yvon (16 minims of the latter are equivalent to 16 grains of ergot, and even more if the fluid is concentrated) which is perfectly stable, salicylate of sodium and cherry-laurel water being employed in its preparation. M. Schmitt says that the method by which Yvon's extract is prepared is tedious and awkward ("Répertoire de Pharmacie," 1880, p. 294). [The extractum ergotæ of the U. S. Ph., and the so-called "purified ergotin" of commerce, which contains all the alcohol-soluble constituents with exclusion of the inert water-soluble ones, is considered by competent authorities to be equally reliable.—R.]

Wigger's ergotine is soluble in alcohol, but insoluble in

water and in ether; Bonjean's, on the other hand, is soluble in all three vehicles.

Dr. Kobert has obtained three new principles from ergot which he names ergotinic acid, sphacelinic acid and cornutin. This author has only experimented on the lower animals. [The results obtained by various observers are vague and contradictory. This discordance is probably due to differences in the preparations used, to uncertainty in composition, and to changes which have occurred in them by keeping.] We certainly do not seem to have arrived as yet at a definite knowledge of the active principles of ergot. Uncertainty increases with fresh researches, and many of the variously named active principles are but imperfectly known, and confounded with one another.

Chief Physiological Actions.—In therapeutic doses, so far as we know, no abnormal phenomenon has ever been observed. In man, large doses (ʒ ij.), or long-continued small doses, produce the following symptoms: vertigo, weight of head, feeling of lassitude, tinglings, numbness of the ends of the fingers and toes, fugitive pains, convulsive paroxysms (clonic and tonic), sometimes epileptiform and accompanied by contractions, violent pains and cutaneous anæsthesia, erysipelatous swelling followed by gangrene. There is contraction of the involuntary muscular fibres of the uterus, blood-vessels, etc. The effects observed on the circulation are absolutely contradictory. According to Trousseau and Boissarie, ergot has the property of accumulating in the system and may then produce, after long-continued small doses, an onset of gangrene.

Local Effects.—All the preparations of ergot when injected hypodermically cause intense persistent pain and inflammatory symptoms. Dr. Eulenburg states that he has not observed pain from the use of Bonjean's ergotin.

[This quotation appears to be inaccurate. In the "Handbook of Therapeutics," loc. cit., p. 468, Prof. Eulenburg recommends Bonjean's ergotin 2.5, glycerin and distilled water, of each, 7.5, 1 to 2 syringefuls = 2¼ to 4½ grains of the extract, and he adds "the injection of this solution is always somewhat painful, and is often accompanied by the formation of small obstinate lumps or indurations at the seat of puncture." I have repeatedly used the ergotin in tabloids of Messrs. Burroughs and Wellcome, and find that if injection is made deeply

into the muscular substance there is no pain beyond that caused by the prick of the needle, and there are no unpleasant local after-effects.—*Trans.*]

M. Luton has seen inflammatory indurations and gangrenous abscess after the injection of 16 grains of ergotin (Grandval's extract) in solution in water. The same author states that he has never seen suppuration result from the injection of 16 minims of a 1 in 50 alcoholic tincture which he recommends. Drs. Dujardin-Beaumetz, Bourneville and Gœnner state that Yvon's ergotin never entails local accident, and Messrs. Bénard and Herrgott likewise have not met with pain, induration, or other local trouble from its use.

Aqueous extract of ergot, . .	2 grains
Glycerin, ...	12 minims
Distilled water,. . . .	up to 24 minims.

Twelve minims = 1 grain of extract.

(*Albanese.*)

Ergotin, ...	4 grains
Cherry-laurel water, . .	up to 24 minims.

Dose.—12 to 16 minims for one injection, to be given every 2 or 5 days. (*Vidal.*)

This was used in the treatment of prolapsus ani, the injections being made in the neighborhood of the anus; cure in 20 days. We have used ergotin at the Bicêtre in the treatment of this affection. The injections, which were practised daily, produced at first no local accident, but after a time two abscesses formed which were followed by cure of the prolapsus. We used a solution of 4 grains of Bonjean's extract in equal parts of glycerin and water up to 32 minims. M. Jette asserts that either Bonjean's or Yvon's ergotin may be used, but that all others should be rejected.

The duration of treatment varies from a few days to several weeks.

[When "ergotin" (or "ergotine") without any further specification is prescribed, or mentioned by an author, the nationality of the latter may help to decide, what preparation is intended. A French physician or writer would probably mean Bonjean's preparation. In this country (U. S.), either the latter or "purified ergotin" (a purified extractum ergotæ,

U. S. Ph.) may be dispensed. There is no fixed definition of the term "ergotin."—R.]

Ergotin,	3 grains
Glycerin,	2 minims
Water,	up to 18 minims.

(*Hildebrandt.*)

Ergotin,	2 grains
Glycerin,	16 minims
Distilled water,	up to 32 minims.

(*Moutard-Martin and others.*)

Terrier used this solution of double strength in the treatment of metrorrhagia due to uterine fibroid. Sixteen minims were injected daily.

Ergotin (Yvon),	12 grains
Water,	up to 96 minims.

(*Dujardin-Beaumetz.*)

Peton and other authors state that they have found this ergotin produce pain and indurations.

Ergotin,	2 grains
Distilled water,	up to 32 minims.

(*Bucquoy*).

Dr. Eulenburg observed slight pain but no local inflammation from 16 minims of this solution.

Dr. Jaccoud administers 2, 3, and 4 daily injections of 16 minims of the following solution in the treatment of hæmoptysis, unaccompanied by pyrexia, in tubercular phthisis.

Ergotin,	4 grains
Glycerin,	18 minims
Cherry-laurel water,	9 minims
Distilled water,	up to 48 minims.

Ergotin,	1 grain
Alcohol,	32 minims
Glycerin,	up to 84 minims.

Dose.—6 to 12 minims = $\frac{1}{14}$ to $\frac{1}{7}$ of a grain of ergotin.

(*Eulenburg.*)

This solution was used successfully in a case of convulsive cough in a child of 4 years; 11 injections were made in 20 days.

Ergotin,	6 grains
Alcohol,	
Glycerin,	of each, 6 minims
Water,	up to 24 minims.

(*Stephano Tolini.*)

Extract of ergot,	4 grains
Glycerin,	20 minims
Water,	up to 48 minims.

Dose.—16 to 32 minims.

Ergotin (Bonjean),	16 grains
Chloroform,	4 minims
Water,	up to 64 minims.

Each minim contains ¼ of a grain of ergotin. The chloroform is added to the solution to make it keep well for a considerable time and to lessen the pain of the injection; the proportion of chloroform, however, does not seem to be sufficient to effect this purpose.

Ergotinine,	2 grains
Lactic acid,	1 minim
Alcohol,	22 minims
Cherry-laurel water,	220 minims.
Water, a sufficiency to make	1120 minims.

Sixteen minims contain $\frac{1}{32}$ of a grain of ergotinine.

(*Tanret and Dujardin-Beaumetz.*)

[Ergotinine (Tanret's) is a feeble base.—R.]

Colic and vomiting were produced when the dose exceeded $\frac{1}{14}$ of a grain. No effect followed until a lapse of from 2 to 24 hours.

Prof. Eulenburg ("Deutsche med. Wochenschrift," 1883, No. 44) has used Gehe's ergotinine in the treatment of headache, neuralgia, Basedow's disease, and nocturnal incontinence of urine. There was hardly any pain, and no local troubles resulted. The dose ranges from $\frac{1}{100}$ to $\frac{1}{10}$ of a grain.

Therapeutic Uses.—All forms of metrorrhagia (Reuben, Landmann), rectal prolapse (Vidal, Perrotin, Michel), retention of urine (Luton), uterine fibroids (Hildebrandt); it has been asserted that injections of ergotin by Hildebrandt's method cause reduction of fibro-myomata, but we cannot find any recorded cases which indisputably bear out this statement); hemicrania (Berger), cephalalgia (Lebert, Eulenburg),

Basedow's disease (Eulenburg), poisoning by carbonic oxide (Remak), hæmoptysis (Drasche, Ritchie and others; Cavalieri in a case of hæmoptysis used a 1 in 2 aqueous infusion of ergot of rye. Observe in passing that if it is desired to obtain a successful result from the use of ergot in these cases, it is absolutely essential that the middle tunic of the vessels should be healthy throughout); hæmatemesis, epistaxis, bleeding hæmorrhoids, varices (P. Vogt), aneurism (Langenbeck: injection between the skin and tumor. Schwalbe attributes the success of Langenbeck and P. Vogt to the irritant and inflammatory local effects of the alcohol used as a vehicle. We are inclined to share this opinion in regard also to other hypodermic solutions of ergotin, that, for instance, used by M. Vidal in the treatment of rectal prolapse. Rouge, Albanese, Eulenburg and others), Werlhof's disease or purpura hæmorrhagica (Piaza of Palermo), hæmaturia (Luton), dangerous hemorrhage resulting from rupture of the bulbous portion of the urethra (Albanese, who used it successfully) splenic leucocythæmia (Da Costa found that it diminished the spleen), varicocele (Wycisk), neuralgia (Marino, of Palermo), diabetes, various kinds of convulsion (Corrigan), phthisical cough (Allan).

The alcoholic tincture recommended by M. Luton in 16-minim doses, which according to this author never produced suppuration, does not appear to have been free from irritating properties in the hands of M. Stocquart.[27]

Ergot of rye is often administered in an empirical haphazard fashion to promote uterine contractions. We may recall the fact that the best modern accoucheurs, among others, Naegele, Schröder and Playfair, condemn this practice, which is dangerous alike to mother and child on account of the persistent spasmodic contraction which it induces. Moreover, the danger of premature closure of the os before the third stage of labor is completed must not be forgotten. For these and other reasons, which it is unnecessary to enlarge on here, ergot and its compounds ought not, in our opinion, to be employed under any circumstances in the pathology of parturition. In short, we think that the indications for the use of ergot are comprised within a very narrow compass.

[I am indebted to my friend Dr. Halliday Croom, of the Edinburgh Medical School, for the following prescription,

which, he assures me, causes neither inflammation nor abscess:

Ergotin, ...	120 grains
Chloral hydrate, . . .	20 grains
Water, to make, ...	1 fluidounce.

S. Thirty minims for one injection.

The formula in the last edition of the "British Pharmacopœia" is as follows:

Ergotin, . . .	100 grains or 1 part
Camphor water, .	200 fluid grains or 200 parts

Dose.—3 to 10 minims.—*Trans.*]

ESERINA.

(*See Physostigmina.*)

EUCALYPTOL.

Eucalyptol is soluble in alcohol and practically insoluble in water; it is an antifermentescent and antiputrescent. This agent produces, in doses of from 32 to 64 grains, cephalalgia, physical and mental prostration, loss of reflexes, failure of respiration, fall of blood pressure and temperature. *In Poisonous doses* death occurs from arrest of respiration. *Therapeutics.*—Eucalyptus and its derivatives have been often used successfully both internally and externally in a great variety of diseases, but eucalyptol has only been administered subcutaneously by Dr. Sloan, who states that he has saved patients suffering from severe puerperal fever.

[A paper by Dr. Sloan on the use of eucalyptus oil in midwifery will be found in Braithwaite's "Retrospect," vol. 86, p. 278.—*Trans.*]

FERRUM.

Iron (and its Salts and Preparations: Dialyzed Iron—Pyrophosphate of Iron—Citrate, Tartrate and Lactate of Iron—Peptonate of Iron).

Dialyzed iron, diluted and undiluted, has been used by Da Costa in doses of 15 minims in cases of anæmia. M. Luton has injected it in doses of 3, 5 and 10 minims; "deprived of its styptic and astringent properties, it is nearly as well borne by the cellular tissue as perfectly neutral solutions of morphine, it is rapidly absorbed and locally gives rise to nothing more

than a trifling nodosity, which, however, persists for a considerable time. The immediate effects are similar to those of an energetic diffusible stimulant, a sense of warmth more agreeable than painful is diffused throughout the body, the arteries pulsate strongly, the countenance is flushed, there is increased mental activity, rapidity of thought and desire for exercise. In a word, one might admit, as it were, a species of ferric intoxication, which borders afterward upon a decidedly feverish condition. These effects last some time, proportionally to the dose injected, and are never followed by prostration, but by a certain degree of anorexia. M. Luton has also observed a reawakening of the generative desire, and a love of dress (not of a sombre hue). Nasse, after using a 5 per-cent solution, abandoned it on account of the violent inflammation produced by the injections.

The pyrophosphate of iron (with ammonium citrate) has been used hypodermically in cases of severe anæmia and chlorosis by Messrs. Huguenin, of Zurich, in 1876, Wychinski (with the addition of a small quantity of albumen), N. Neuss (1881) who in one-third of his cases observed signs of local irritation, Lippert, Nasse (for abscess), Messrs. Martensen (1876), Rosenthal (1878) and Neuss employed pyrophosphate of iron with citrate of sodium.

[Pyrophosphate of iron, prepared by double decomposition between pyrophosphate of sodium and a ferric salt, is insoluble. When combined with the citrate of an alkali, however, it is readily soluble. The pyrophosphate of iron of the U. S. Ph., previous to the last revision, contained citrate of ammonium, which was replaced by citrate of sodium, as this renders the compound more permanent.—R.]

Pyrophosphate of iron (with ammonium citrate), . . . 3 grains
Distilled water, . . . up to 16 minims.
(*Huguenin.*)

[Sixteen minims of this solution are equivalent to about ½ grain of iron.—*Trans.*]

Pyrophosphate of iron (with sodium citrate), ... 2½ grains
Distilled water, . . . up to 16 minims.
Eight to sixteen minims for a dose.
(*Martensen, Rosenthal, Eulenburg.*)

The solution should be prepared as required and kept in a cool place. Iron is detected in the urine thirty minutes after injection. Messrs. Nasse and Rosenthal have often met with local accidents after its administration.

The *citrate of iron and ammonium* has been administered subcutaneously by Messrs. Quincke (1867), Ciamarelli (1879) Vincenzio Gauthier, of Naples (¾ grain to 16 grains), and that with success, in cases of anæmia which have resisted all other methods of treatment by iron. The presence of iron was detected in the urine; locally there was a sense of burning, but not to an insupportable degree.

The *citrate of iron* is recommended by M. Glœveke of Kiel[28] and by Martinetti, in doses of 1½ grains, in a ten-per-cent solution, for adults. Chiara (1885) has used it with benefit and without local mishaps.

Citrate of iron,	2 grains
Cherry-laurel water,	up to 24 minims.

The *tartrate of iron* [probably "tartrate of iron and ammonium."—R.] used by Rosenthal in aqueous solution (3½ grains in 16 minims) produced local accidents, such as redness, swelling, and persistent hardness. He also used the *lactate of iron*, after Eulenburg's researches. M. Luton has experimented on himself with a solution (1 in 10) of lactate of iron. He found it impossible to inject it so as to cause absorption.

M. Bouchut has made injections with perchloride of iron and, naturally, has caused very considerable sloughs.

Finzelberg's *peptonate of iron* has been used hpodermically by M. Nasse since 1879 in cases of insanity, with benefit and without local troubles. Sixteen minims of a one-in-ten solution boiled and filtered represent 1½ grains of peptonate of iron and nearly ½ grain of oxide of iron. The solution should be kept in a cool place and prepared fresh whenever it becomes turbid.

Pepsin (dry),	5 grains
Solution of chloride of iron,	6 minims
Glycerin,	55 minims
Water of ammonia,	10 minims
Cherry-laurel water,	up to 240 minims.

(*Jaillet and Quillet.*)

A Pravaz syringe, or 16 minims, is equivalent to ½ of a grain of pepsin and ¾ of a grain of the iron salt.

This solution causes neither pain nor local inflammation if it is injected at a temperature of 98.5° to 100° F.

More recently M. Jaillet has suggested the following formula for injection:

Chloride of iron (ferric), sublimed, .	1 grain
Pepsin (dry), ...	2 grains
Glycerin, ...	40 minims
Distilled water, . .	60 minims or a sufficiency.

1. Dissolve the pepsin in a small quantity of water and add the glycerin. 2. Dissolve the chloride of iron in the remainder of the water and mix the two solutions. 3. Add finely powdered, dry sodium carbonate until the liquid is entirely neutral. 4. Complete the solution by adding distilled water to make up the product to 112 minims, and finally filter. This solution keeps better than the preceding.

M. Rosenthal, of Vienna, recommends, when the stomach is intolerant of ferruginous preparations, hypodermic injections of a 1-in-20 solution of iron peptonate in olive oil. It never produces inflammatory troubles. The same author has used a 1-in-10 solution of iron peptonate.

Albuminate of iron was first used by Dœnitz of Tokio (1879) as a solution of iron sesquichloride with albumen. Friedländer's 1-per-cent solution of iron albuminate speedily became turbid and was very unstable (Neusse). [There is no definite process or formula for "albuminate of iron" and similar preparations. It is probable that many experimenters have used preparations, the exact composition of which was not known. Very little reliance can, therefore, be placed upon their reports. —R.]

In 1880 Goldmann used the following solution with success:

Pyrophosphate of iron, . . .	3 grains
Albumen, ...	4 grains
Distilled water, ...	up to 16 minims.

According to Eulenburg ("Berlin. klin. Woch.," 1883, No. 2), Drees' solution of iron albuminate was found useful in hypodermic injections.

Albuminate of ammonio-citrate of iron [?] has been sug-

gested by M. Vachetta; he has, however, only tried it in animals.

We will not discuss here injections of iron in nævi, varices, aneurisms, etc.

GELSEMII TINCTURA. GELSEMINA.

Tincture of Gelsemium. Gelsemine.

Chief Physiological Effects.— Gelsemine paralyzes the motor centres of the brain and the respiratory centres (Berger, Moritz, Ott); it first increases, then diminishes reflex excitability of the spinal cord and the cardiac contractions. These symptoms are complicated with weight of head, vertigo, diplopia, impeded movements of the tongue, tremor of the hands, numbness of the fingers, nausea, vomiting, dyspnœa, feeling of general cold (Berger), mydriasis after instillation into the eye (Moritz). The lethal dose of Sonnenschein's gelsemine, according to Moritz, would be from about $\frac{1}{2}$ to 1 grain [this is a *serious* error. The alkaloid *gelsemine* is a most energetic poison, and its dose is given, with some hesitation, by several authorities (for instance, Prof. H. C. Wood) as between the 200th and 300th of a grain. The quantity mentioned in the text probably refers to the eclectic "resinoid" gelsemin. —R.], and from $\frac{3}{4}$ to $\frac{1}{2}$ a grain of liquid extract.

Hydrochlorate of gelsemine,	1 grain
Distilled water,	up to 210 minims.

From $1\frac{1}{2}$ to 3 minims, equivalent to $\frac{1}{40}$ to $\frac{1}{70}$ of a grain of salt. The hydrochlorate is more active than gelsemine itself. It produces insensibility at the point of injection.

Therapeutic Uses.—Tincture of Gelsemium sempervirens has been successfully used in the treatment of neuralgia by Drs. Jurasz, Wickham Legg, Thomson, Clarke and others, and without benefit by Messrs. Berger, Wolfe and others. Prof. Eulenburg has injected sometimes the tincture or aqueous extract of gelsemium, at others gelsemine (soluble in 116 parts of water), or again, an aqueous solution of the hydrochlorate —1 in 200 parts. This last, which is much more active than gelsemine, had already been recommended by Sonnenschein.

GLYCERINUM.

Glycerin.

Glycerin is one of the most valuable solvents for hypodermic preparations; it is, however, of great importance to use it chemically pure so as to avoid its irritant action. Glycerin is frequently administered by the mouth in various affections; it is thus used frequently as a substitute for cod-liver oil, but in such cases the doses required are too large to permit of its being used hypodermically. See in the Introduction the table borrowed from the essay of M. Surun showing the solvent power of glycerin.

GUACHAMACA.

Guachamaca (Extract of).

Guachamaca is the native name of a tree recognized by Hooker as *Malonetia nitida* Spruce (nat. ord. Apocynaceæ), which grows in Venezuela. The active principle is chiefly contained in the bark and in the various layers of the liber. The extract, dark-brown and resinous, bearing an outward resemblance to the appearance of curare, is soluble in water, slightly so in absolute alcohol, and insoluble in ether and chloroform. The chief difference, according to M. Schiffer, between the action of this substance and that of curare consists in the fact that guachamaca appears to act rapidly on the nerve-centres, whilst curare affects them slowly.

M. Schiffer has as yet used it but seldom in the human subject by the hypodermic method. In a case of spasmodic muscular contracture he injected a Pravaz syringeful containing ¼ of a grain of dried extract. He observed in three-quarters of an hour a light, and then profound, slumber which lasted about three hours, the circulation and respiration remained normal, reflex excitability being preserved during the period of somnolence.

The author thinks that in this case perhaps the dose was too small to obtain the full effect; he is of opinion that the remedy should be administered for some time to obtain a curative effect in convulsive diseases. He puts forward a hypothesis that guachamaca might be useful as a hypnotic.

[A paper on guachamaca will be found in the "Lancet," vol. i., 1884, p. 723.—*Trans.*]

HOMATROPINÆ HYDROBROMAS.

Hydrobromate of Homatropine.

Homatropine, according to Fronmüller ("Memorabilien," 1880, p. 298, 1882, p. 6), does not include any of the poisonous features of atropine; its local mydriatic action is quick and decided (2-per-cent solution), and the pupil rapidly returns to the normal condition. It diminishes tubercular sweats.

Hydrobromate of homatropine, . 1 grain
Distilled water, . . . up to 80 minims.
Sixteen minims = $\frac{1}{5}$ of a grain.

[Dose $\frac{1}{120}$ to $\frac{1}{90}$ grain, *Martindale.*]

Neither mydriasis nor narcotic phenomena are induced, cough, expectoration and insomnia are relieved.

Dr. William Murrell has found these injections less efficacious than those of atropine. Homatropine has been used, among other remedies, in cases of poisoning by pilocarpine (Fronmüller).

HYDRARGYRUM.

Mercury. Preparations and Salts of Mercury.

(Excepting *Calomel*, which see under *Hydrargyri Chloridum Mite.*)

Bichloride of mercury is soluble in 16 parts of cold water, and freely soluble in alcohol, ether, and glycerin. Cyanide of mercury is soluble in 13 parts of cold water, and slightly soluble in strong alcohol and in glycerin. Biniodide of mercury is practically insoluble in water and in glycerin, but soluble in alcohol and in ether. In *small doses*, according to some authors, mercury is stimulating and restorative. It is antiseptic.

Chief Physiological Properties.—Stomatitis, more or less speedily produced according to idiosyncrasy or local predisposing causes, such as caries, the use of tobacco, etc., salivation, intestinal catarrh, diarrhœa. Mercurials often produce

notable slowing of the circulation and fall of temperature. Mercurial fever is generally due to local irritations produced by these preparations (Barrallier).

We omit the poisonous effects properly so-called. We will quote, however, some of the results recorded in the remarkable work of J. L. Prévost ("Étude expérimentale relative à l'intoxication par le mercure.—Son action sur l'intestin—Calcification des reins parallèle à la décalcification des os."—"Rev. méd. de la Suisse Romande" (Nov. and Dec., 1882). M. Prévost used for his physiological experiments aqueous solutions of the acid nitrate of mercury, of corrosive sublimate, and of the peptonate. The results obtained by him tend to confirm those recently obtained by Messrs. Salkowski, Rosenbach, Heilbronn, Mering, and to elucidate some hitherto doubtful points. These experiments prove that mercury is capable, at least in large doses, of producing by the hypodermic method *intestinal lesions* quite as serious as those following ingestion by the stomach, though the latter method requires larger doses to produce the same amount of mischief. These lesions mostly consist in very pronounced hyperæmia of the cæcum and large intestine with ecchymotic patches, sometimes also with ecchymosis of the vesical mucous membrane; they have also been observed by authors who have experimented with hypodermic injections of corrosive sublimate.

Experimental mercurial poisoning, whether produced by large doses administered internally, or by smaller doses exhibited hypodermically, produces, when death supervenes only after a few days, an accumulation of calcareous matter in the renal tubules, more or less pronounced according to the species of animal. The process begins in the straight tubules of the cortex, and extends afterward to the convoluted tubules as they traverse the medullary substance. This effect was first observed by Salkowski in his experiments with calomel, corrosive sublimate, and the iodides of mercury.

Several writers, among others Astley Cooper and Küssmaul, had long previously attributed to mercury and its preparations the power of exciting osseous changes. See among others the history of the painter's dog recorded by Hughes Bennett. [This case is recorded in the 5th edition of Bennett's "Clinical Medicine," p. 978, and is of great interest and importance.—*Trans.*] Some modern writers (Heilbronn, Mer-

ing, etc.), have also seen these alterations in the bones, but without associating them with the renal changes.

In one of Prévost's experiments (No. XII.), it was found that an injection of 40 grains of mercuric peptonate, which was an old and turbid preparation containing ⅓ of a grain of corrosive sublimate, produced violent diarrhœa, lasting for two days, and death on the third day; at the autopsy, besides marked renal calcification, he found manifest signs of decalcification of the bones which rendered the heads of the long bones movable on their shafts.

Chronic Mercurialism.—According to Küssmaul, mercury is a brain poison, one of the most constant phenomena being the condition of timidity and embarrassment which characterizes mercurialized persons, falling out of the teeth, shrinking of the gums, chronic inflammations of the mouth and pharynx, induration of the salivary glands and of the cervical ganglia, gastric catarrh, pains in the limbs, nervous excitability, insomnia, vertigo, tremors, impairment of memory, frequently emaciation, dental neuralgia, headache, dyspnœa, tinglings, anæsthesia and analgesia.

Mercury in medicinal doses has no appreciable influence on the formation of urea; but it is generally admitted that its prolonged use is attended with diminution of globulin.

In 1880 M. Luton injected two or three globules of crude mercury into the cellular tissue of the dorsal aspect of the forearm; the operation was succeeded by a somewhat persistent induration and sometimes by slight suppuration, but absorption, nevertheless, took place. Later on he used mercury emulsified with glycerin (3 globules of fluid mercury shaken up vigorously and for some time with 16 minims of glycerin; the entire quantity was injected under the skin of the thigh behind the great trochanter). "Mercury thus treated assumes really the appearance of a grayish metallic powder, and requires a canula of large calibre to permit of its ready expulsion from the syringe." It is necessary to use a needle made of steel, and syringes, such as those made of vulcanite, the joints of which are not subject to the chemical action of the mercury. This form of injection only causes a very moderate amount of local irritation, but it is followed by persistent induration. M. Luton asserts that the advantage of this method consists in the fact that "the patient carries his remedy stored

up (emmagasiné) in himself." If the dose has been sufficient there is no need to repeat the injection, but M. Luton admits that "the supply may require renewal if the trouble has not quite disappeared, and especially if, before the desired result has been attained, the local irritation has vanished." He always obtained excellent results from the use of this method in the treatment of secondary and tertiary syphilis.

Hunter and Hebra (1864) appear to have been the first to use corrosive sublimate hypodermically, one grain in one to four drachms of water; Berkeley Hill, in England, also used hypodermic injections of mercury in the form of mercuric chloride; then come Drs. Walker and James (1869) and McCall Anderson (1870).

Messrs. Scarenzio (1864), Ambrosoli, Riccordi, Monte-Forte, Casati (1867), Max van Mons, Sigmund, Soresina (of Milan), Bertarelli (1879), etc., used injections of calomel (which see). These injections have latterly been used by preference and exclusively in the Grand Hospital at Milan.

To Dr. Lewin, of Berlin, belongs the merit of popularizing this mode of using mercury bichloride.

Bichloride of mercury, . . .	1 grain
Distilled water, . . .	up to 168 minims.

Dr. Lewin injected 12 minims of this solution, to which he sometimes added morphine and glycerin. He seldom observed local troubles as a result (abscess in 2 to 3 per cent). Messrs. Richter, Bœse, Klemm, Derblich, Wiederhoffer, Eulenburg (an aqueous solution of 3½ grains in 4 drachms and 15 minims), and Rosenthal (solution made with water and glycerin) used Lewin's method successfully. This plan of treating syphilis has been also used since its introduction with varying success by Hardy, Diday (who noted pain, abscess and sloughing), Walker, Taylor, Hansen, H. Zeissl (who used hydrarg. perchlor., gr. xvi.; glycerin., ℥ iiss.; aq. dest., ʒ v. ♏xx. Messrs. Merscheim, Grünfeld (of Sigmund's clinic) and Stohr, but especially the last author, oppose the method recommended by Lewin. Stohr, besides the inconveniences encountered by other authors, has observed general enfeeblement, febrile attacks, and, occasionally, diarrhœa. In 1863 Stohr's observations were confirmed by Uhlmann, Rosenthal, Fournier and

Kolner. Paikert did not meet with any accidents in 5,000 injections made after Lewin's method; the syringe which he used had a capacity of 32 minims. Ædsmaason also has not seen a single case of abscess.

In France, Liégeois in his turn recommended hypodermic injections of corrosive sublimate in the treatment of syphilis; he used the following solution:

Bichloride of mercury, . . .	1 grain
Glycerin, ...	160 minims
Distilled water, . . .	up to 560 minims.

Two injections of 16 minims daily into the dorsal region. In 25,000 injections he only observed suppuration thrice. Sometimes Liégeois modified his formula thus:—

Bichloride of mercury, . . .	1 grain
Hydrochlorate of morphine, . .	½ grain
Distilled water, . . .	up to 560 minims.

Messrs. Piquand (1868), Gubler, Léon Labbé, Marc Sée, Simonet, Spillmann, Hardy, Galezowsky, Giraud-Teulon, Tillaux, Diday, Dron,[29] H. Bernard (1871), Le Moaligou (1873), following in the steps of Liégeois, used that author's solutions with more or less success.

M. Bergh, of Stockholm, never met with suppuration or other accidents after hypodermic injections of sublimate, and he attributed this immunity to methodical massage of the nodule resulting from injection immediately after its production. He advises that injections should be made into parts richly provided with cellular tissue, *e.g.*, the back and shoulders. Dr. Shoemaker uses a one-per-cent solution of sublimate in distilled water; he uses gold canulæ.

M. Straub, of Strasbourg (1872), in Schützenberger's clinic, administered corrosive sublimate hypodermically in a chloro-albuminate solution, which had previously been tried by M. Lewin. The composition of this solution, which has been praised by M. Mialhe, is based on the theory that solution of mercury bichloride in contact with living tissues precipitates their albumen, and thus causes pain and other local accidents, whilst by combining it in the first place with albumen its absorption is effected without tissue changes.

a.	Bichloride of mercury, . . .	20 grains
	Chloride of ammonium, . . .	20 grains
	Chloride of sodium, . . .	68 grains
	Distilled water, . .	up to 2240 minims.
b.	The white of one egg,	
	Distilled water, . .	q.s. up to 2240 minims.

Mix the two fluids and filter. Sixteen minims of the liquid are equivalent to $\frac{1}{14}$ of a grain of the salt. Le Moaligou, Sée and Grünfeld, who tried this solution, found that it was unstable, painful to use, and capable of producing sloughing and abscess. The solution of sublimate in glycerin is preferred by some authors. D'Ancona in Italy (1876) used a solution of albuminate of mercury with chloride of sodium.

Bichloride of mercury, . . .	1 grain
Chloride of sodium, ...	6 grains
Distilled water, . . .	up to 112 minims.

Rub in a porcelain mortar, dissolve and filter.

(*Bamberger.*)

M. Van den Corput, of Brussels, has suggested another formula:

Bichloride of mercury, . . .	1 grain
Chloride of sodium, ...	10 grains
Distilled water, ...	up to 1 ounce.

Three to five minims thrice daily, = $\frac{1}{160}$ to $\frac{1}{96}$ of a grain.

The formulæ of Dr. Stern, formulæ which recently had great publicity, differed but slightly from the preceding, the solutions being slightly more concentrated. Messrs. Rechtvall (who performed 2,937 injections, suppuration resulting in 8 to 17 per cent of the cases), Jarmay, Reder and Gschirhakl recommended the combination of sodium chloride with the sublimate.

Auspitz used the following solution:—

Bichloride of mercury, . . .	1 grain
Chloride of sodium, ...	2 grains
Distilled water, . . .	up to 112 minims.

This is the solution which Abadie and Leleu used in the treatment of interstitial keratitis ("Gazette médicale de Paris," May 3d, 1884. "De la kératite interstitielle et de son traitement par les injections de bichlorure de mercure," Paris,

1884). The latter used it in 8-minim doses in children, and 16 minims in adults. Injections should be made deeply to avoid accidents.

M. Plevani adds hydrochlorate of cocaine to the solution to render the injection painless, and chloride of sodium to prevent the precipitation which would otherwise ensue from the formation of an insoluble double chloride of mercury and cocaine.

Bichloride of mercury, . . . 3 grains
Hydrochlorate of cocaine,
Chloride of sodium, . . of each 1 grain
Distilled water, . . . up to 336 minims.

Sixteen minims = $\frac{1}{4}$ of a grain of mercury salt, and $\frac{1}{21}$ of a grain of cocaine.

Martin has used biniodide of mercury subcutaneously.

Biniodide of mercury, . . . 4 grains
Distilled water, . . . up to 112 minims.

Some add 4 grains of potassium iodide to effect solution; in this way a double iodide of mercury and potassium is formed.

Sulphate of atropine, . . . 3 grains
Bichloride of mercury, . . . 20 grains
Distilled water, . . . up to 4 fluidounces.

Dose.—Eight minims. This solution did not produce irritation.

Biniodide of mercury, . . . 2 grains
Iodide of potassium, ... 4 grains
Hydrochlorate of morphine, . . $\frac{1}{2}$ grain
Distilled water, . . . up to 112 minims.

Eight minims (= $\frac{1}{4}$ grain of mercury salt) every second day.

Biniodide of mercury, . . . 3 grains
Iodide of potassium q.s. to effect solution in
Distilled water, . . . up to 210 minims.

Five minims = $\frac{1}{14}$ of a grain.

(*Ragazzoni.*)

Biniodide of mercury, . . . 6 grains
Iodide of potassium, ... 50 grains
Distilled water, . up to 2 ounces 192 minims.

16 minims = $\frac{1}{12}$ of a grain of mercury salt.

Bricheteau has recommended the use of double iodide of mercury and sodium.

Biniodide of mercury,	3 grains
Iodide of sodium,	3 grains
Distilled water,	up to 240 minims.

A Pravaz syringeful (or 16 minims) contains ½ of a grain of the mercury salt. Eight, gradually increased to 16, minims every second day. The following solution gave rise to no local reaction, was absorbed rapidly and did not coagulate albumen:

Biniodide of mercury,	1 grain
Iodide of potassium,	1 grain
Phosphate of sodium,	2 grains
Distilled water,	up to 50 minims.

Five minims = $\frac{1}{10}$ of a grain.

(*Yvon.*)

Cullingworth in 1875 used cyanide of mercury in solution in glycerin and distilled water. This author used Staub's solution at first, but, though it produced no suppuration, its administration was painful and it readily decomposed. The salt is sometimes called "bicyanide of mercury." Sigmund and Kroworzinski used it later (1876) in aqueous solution.

Cyanide of mercury,	3 grains
Distilled water,	up to 6 drachms.

Twelve minims of the solution daily = $\frac{1}{10}$ of a grain. Cullingworth asserts that it does not cause pain; it should be remarked, however, that he observed infiltration of the cellular tissue persisting for a week. Mandelbaum used, in 1878, a solution of 1 grain in 112 minims and only observed trifling pain lasting at most for an hour.

Galezowsky and Despagnet injected 4 minims (= $\frac{1}{30}$ of a grain) of the following solution:

Cyanide of mercury,	1 grain
Distilled water,	up to 224 minims.

According to Lagelouze, the above dose caused diarrhœa, vertigo, and giddiness.

Galezowsky has endeavored to substitute for hypodermic injections of mercury cyanide, which in doses exceeding $\frac{1}{17}$ to ¼ of a grain produced intractable diarrhœa, those of the double

cyanides of gold and potassium, of silver and potassium, and of platinum and potassium.

Cyanide of gold and potassium, . 2 grains
Distilled water, . . . up to 112 minims.

The dose used was from 16 to 24 minims (= $\frac{2}{3}$ to $\frac{3}{4}$ of a grain) and it was well borne.

Cyanide of mercury was particularly recommended for hypodermic use by Schütz and Prochorow. It is soluble in 13 parts of water, is neutral in reaction, has no chemical action on albumen nor on the metallic parts of the syringe, and is very stable if the solution is kept under cover from the light. It is injected in doses of $\frac{1}{14}$ to $\frac{1}{4}$ of a grain (2 per cent solution), the maximum dose being less than $\frac{1}{2}$ a grain; the injections cause less pain than those of bichloride. Discomfort lasts about two hours.

[In the original as well as in the English edition of this work, this salt is called *cyanate of mercury*, and evidently regarded as being different from *cyanide of mercury*. The fact is, that "cyanate of mercury" is a wrong translation of *Hydrargyrum cyanatum*, which, in English, is properly "cyanide of mercury." True cyanate of mercury is a different substance and has never been used in medicine.—R.]

"Two solutions have been recommended by Vienna physicians—the *albuminate* (bichloride of mercury 4½ grains, solution of albumen ten drachms and 40 minims (Bamberger), and the *peptonate of mercury*. [According to Galezowsky, the double peptonate of mercury and ammonium which he has experimented with in conjunction with Fournier has not appeared to possess any greater value.] The albuminate is difficult of preparation, and will not keep long without becoming turbid; but it is essential to inject a perfectly clear solution. Bamberger has recently experimented with the peptones which are largely manufactured in England for the alimentation of convalescents and he has obtained marked success. The two disadvantages which were encountered with albumen do not exist with regard to the peptonates; the latter are freely soluble in water, are easy of filtration, have no tendency to become turbid, and are not precipitated by heat, by acids, or by alkalies."

"The meat-peptone which Bamberger uses is prepared in

London, by Stephen Darby of Leadenhall Street. The preparation of the peptonate is very simple:—dissolve 5 grains of sublimate in 110 minims of distilled water, and make another solution of 20 grains of sodium chloride in 110 minims of water. Dissolve 1 grain of meat peptone in 55 minims of distilled water and filter; add to this 22 minims of the sublimate solution and dissolve the resulting precipitate with a sufficiency (about 16 or 18 minims) of the solution of sodium chloride, and add distilled water up to 100 minims. Cover the liquid and let it rest several days, then filter and make up to 112 minims. Sixteen minims of this solution contain ¼ of a grain of mercury in combination with peptone. The vessel is kept closed and the fluid is allowed to stand for a few days when a small quantity of white flocculent precipitate separates which, perhaps, is albumen which has been retained in the peptone. Finally, the fluid is filtered and is ready for use. This preparation, which we have seen used in the Vienna hospitals, will keep perfectly clear for at least three months. Undoubtedly, as in the case of morphine injections, we meet with instances where idiosyncrasy and susceptibility are so pronounced that we are obliged to lay aside this form of medication, but such cases are extremely rare, the great majority of patients tolerating it without any difficulty. The results of experiments made by Professors Bamberger, Zeissl, and Neumann are in complete accord; the peptonate of mercury causes less disturbance than any other preparation, the reaction consisting merely in a moderate degree of pain at the point of injection, and this would appear to be due to traumatism of the subcutaneous cellular tissue; Bamberger therefore recommends slow injection and the dispersion of the fluid by gentle pressure on the skin and by friction."

Solutions of peptonate of mercury have since been used by various authors; amongst others by Paulcke of Leipzig, Friedländer of Berlin, Neumann, Rotter, Petersen, and Oberländer.

Sublimate injected in minute doses in the form of albuminate or peptonate does not cause the slightest local irritation, provided the solution has been carefully filtered and is perfectly limpid (Nothnagel and Rossbach).

Dr. Terrillon used at Lourcine, with benefit, Bamberger's mercuric peptonate and Yvon's solution. M. Yvon, accepting the theory that the mercurial solution should not only not

excite any local action, but, moreover, should not coagulate albumen in order that it may be absorbed as rapidly as possible, has, to attain these results, prepared the following formula:

Biniodide of mercury, . . .	2 grains
Iodide of potassium, . . .	2 grains
Phosphate of sodium, . . .	4 grains
Distilled water, . .	up to 112 minims.

He insists on the use of instruments with vulcanite mounting. If the injection is made deeply and slowly (under the skin of the back, legs, and gluteal regions) it does not cause pain or give rise to inflammatory nodosities or abscess. Occasionally there are a few indolent indurations.

M. Delpech, chemist, prepared for M. Martineau a mercuric peptonate, 16 grains of which are equivalent to four grains of sublimate (bichloride of mercury, 160 grains, Catillon's dried pepsin, 240 grains, and 240 grains of ammonium chloride). [We presume any other *good* dry pepsin will answer the same purpose. Catillon's pepsin is practically unknown in this country, where we have several brands of pepsin superior to any European make.—R.] The hypodermic solution is prepared thus—

Peptonate of mercury and ammonium,	1 grain
Distilled water, ...	up to 80 minims.

Twenty minims represent $\frac{1}{16}$ grain of sublimate. This solution keeps good only a few days, but the following is more stable—

Peptonate of mercury and ammonium, .	1 grain
Glycerin, ...	16 minims
Distilled water, ...	up to 80 minims.

The next solution is perfectly stable.

Peptonate of mercury and ammonium, .	1 grain
Glycerin, ...	up to 96 minims.

In conclusion, M. Martineau has administered more concentrated solutions hypodermically; they were prepared by M. Delpech and composed as follows:

Catillon's pepsin, ...	9 grains
Ammonium chloride, . . .	9 grains
Corrosive sublimate, . . .	6 grains.

This mercuric peptonate is dissolved in—

Glycerin, ...	80 minims
Distilled water, . . .	up to 120 minims.

Five minims of this filtered solution added to 23 minims distilled water, yield a hypodermic solution, 16 minims of which are equivalent to $\frac{1}{7}$ grain of sublimate. We have used this solution in children and have only observed transient indurations.

M. Besnier has used in the St. Louis hospital, since 1881, the following formula:

Catillon's dry pepsin, . . .	9 grains
Ammonium chloride, . . .	9 grains
Mercury protochloride, . . .	1–2 grains
Glycerin, ...	85 minims
Distilled water, . . .	up to 112 minims.

Sixteen minims represent $\frac{1}{4}$ to $\frac{2}{7}$ of a grain of mercury salt. The injection should be made into the lumbo-sacral muscles and gluteals. Six injections weekly, beginning with half-a-syringeful. ["Mercury protochloride" is probably here equivalent to "bichloride." The protochloride or calomel would remain absolutely undissolved by the liquid. Still, calomel *has* been given hypodermically (see below).—R.]

The peptonate of mercury prepared by M. O. Kaspar should also be mentioned.

M. Wolf, of Strasburg, uses for hypodermic injections solutions which are freshly prepared as required. These solutions are in the first place made as follows: (1) $1\frac{1}{2}$ grains of dried carbonate of sodium in 112 minims of water; (2) $3\frac{3}{4}$ grains of sublimate in 112 minims of water; (3) glycocol $2\frac{1}{2}$ grains in 112 minims. (The glycocol may be replaced by asparagin, alanine, or sarcosin.) The solutions may be kept an indefinite time; they are mixed in equal proportions when required and a syringeful is injected. (The inner surface of the canula should be platinized.) A syringeful, or 16 minims, contains $\frac{1}{7}$ of a grain of mercuric oxide (International Medical Congress, Copenhagen).

Prof. Liebreich and afterward M. Zeissl administered soluble *formamide of mercury* (hydrargyrum formamidatum) subcutaneously. On the nature and preparation of this compound see "New Remedies," 1883, 281. This new compound is very

stable, does not coagulate albumen, and the mercury rapidly appears in the urine. Liebreich has obtained excellent results from its use in syphilis, injected in 8 to 16 minim doses of a one-per-cent solution. M. Carl Kopp has also used it in 126 cases (3,000 injections); he has abandoned its use in the severe forms of syphilis on account of its rapid elimination, but he believes that it can be advantageously used in the mild forms of syphilis. The relapses are frequent and it is better to administer mercurials internally, for example Lustgarten's oxytannate of mercury.

M. S. Rossa, after having administered the formamide of mercury to a considerable number of patients, concluded that this remedy produced no effect when administered internally, that given hypodermically it is extremely irritating, and, moreover, that its effects are inferior to those of other mercurials.

M. Lavolotski, of Moscow, has used mercurial preparations in 25 cases of syphilis without encountering any local troubles beyond slight pain; according to this author the formamide is preferable to the sublimate, their effects are similar and the local irritation which results is less in the case of the former.

The *glycocholate of mercury* is also used subcutaneously (Streitz); it is made by dissolving 1¼ grains of glycocholic acid in a few drops of distilled water, to which ½ a grain of mercuric oxide is added. After filtration, distilled water is added to bring the solution up to 56 or 112 minims. Sixteen minims are equivalent to ¼ and $\frac{1}{14}$ grain of mercury respectively. [Glycocholic acid exists in the bile and is extracted therefrom by absolute alcohol. When boiled with alkalies, it splits up into glycocoll (or glycocine, or amidacetic acid), and cholic acid.—R.]

The formamide of mercury has been regularly used with benefit by the hypodermic method in the clinic of M. Neisser of Breslau in over 200 cases of syphilis. The injections, which are made into the gluteal muscles, are made slowly, and the portion injected is afterward subjected to systematic massage.

M. Bockhardt has recently introduced a new preparation. Blood serum of the horse, sheep, or ox is sterilized by Koch's method and filtered. Take 40 minims of serum and precipitate the albumen by a *hot* solution of 3 grains of sublimate in

30 minims of water. This precipitate of mercury albuminate is next dissolved by a solution of sodium chloride (1 to 3), and, finally, sufficient water is added to bring the solution up to 210 minims. Ten minims of this solution contain ¼ grain of sublimate associated with albumen. It is neutral in reaction and keeps well if it is preserved in a dark vessel and in a cool place. The author has used it in 23 cases (505 injections); he makes one injection of 10 minims (¼ grain of sublimate) every day or every second day. Three to five injections suffice to make exanthematous maculæ disappear; from 8 to 15 injections are necessary in the case of papular eruptions and of palmar psoriasis, from 8 to 12 for mucous gummata of the genital organs, anus, mouth, etc. The injections are not painful and should be made into the skin of the back, gluteals, and thigh; there never is any local reaction. Mercury can be detected in the urine 48 hours after treatment is inaugurated and for eleven weeks after the last injection.

The combination of *urea* with corrosive sublimate is, according to Schütz, an excellent preparation for hypodermic use. This compound is readily soluble in water, does not precipitate albumen and causes no pain or local effects. It is prepared as follows: dissolve 1 grain of sublimate in 100 minims of warm distilled water, add, when the solution is cool, ½ a grain of chemically pure urea and make the solution up to 112 minims.

The commercial discs which contain $\frac{1}{10}$ grain of sublimate may also be used.

Mercury salts have been used hypodermically in the treatment of diphtheria (Hugo Schulz, 1883).

We purposely omit any reference to the parenchymatous hypodermic use of mercury in the treatment of carbuncle (Bienfait), elephantiasis Græcorum, etc. (Luton, Dominguez, Rigaud).

Various manufacturing firms make hypodermic tabloids, which are very convenient, containing $\frac{1}{60}$ and $\frac{1}{30}$ grain of corrosive sublimate respectively.

There are few subjects in regard to which there is greater contrariety of opinion than that of the utility of subcutaneous injections of mercury in syphilis. Although the subject is not a new one, so much has recently been published that it may be well to indicate generally the opinions which chiefly prevail

among the leading English and Continental syphilographers. In 1878 Dr. Buzzard published his experience of the use of mercurial peptone by hypodermic injection in a series of over 200 cases. The preparation he used was made from the meat peptone prepared by Messrs. Darby and Godson, of Leadenhall Street. "The conclusion arrived at by Dr. Buzzard is that it is safe with ordinary care as regards the formation of abscesses, and that the mercury is absorbed into the system. He believes it, however, to be a painful mode of treatment, even when the injection is made in the back and the solution employed is quite clear. He is disposed to think that it possesses no advantages over mercurial inunctions in cases of gummatous syphilis, or when there is evidence of internal disease, except perhaps the very problematical one of substituting a clean but painful process for one which is as dirty as it is free from personal suffering."

The opinion of Messrs. Hill and Cooper is, like that of Dr. Buzzard, unfavorable to the use of subcutaneous mercurial injections, except in rare and exceptional cases, although they do not appear to question the safety of this method. They recommend these injections only in cases where mercury fails to be absorbed after administration by ordinary methods, or in cases in which it is desirable to bring the patient rapidly under the influence of the drug, as, for instance, in severe affections of the eye, brain, and other internal organs. The bichloride, in minute doses administered twice in the twenty-four hours, is the salt to which these authorities give the preference; and they further recommend that the injections should be made into the flank, in preference to the arms and legs, pain being more likely to follow from injection into the latter regions. Bäumler, while admitting that subcutaneous injections of mercury made with due precautions, beyond the pain which they occasion, need give rise to no local troubles, except in unhealthy persons, yet thinks that the method is not so rapid in its effects as appears at first sight, the rapid disappearance of the external symptoms of syphilis being by no means equivalent to a cure of the disease itself. He also quotes the observation of M. Zeissl to the effect that there is more apt to be recurrence of syphilitic manifestations after hypodermic than any other form of medication. He recommends the back and sides of the thorax as the most appropri-

ate sites for injection. Later observers, among others Villar, Florez, and Schultz, speak highly in praise of antisyphilitic hypodermic injections. The two former authorities recommend injections of mercuric peptone and of cyanide of mercury, and they state that the latter salt is specially useful in cases of ocular, cerebral and medullary syphilis. They claim that hypodermic medication possesses the advantages over treatment by internal administration or by inunction, of being more exact in regard to dosage, in not giving rise to gastro-intestinal troubles, in shortening the duration of treatment, and in rarely causing ptyalism. Schultz uses a combination of mercuric chloride with urea.[30]

HYDRARGYRI CHLORIDUM MITE.

Mild Chloride of Mercury, Calomel.

Scarenzio, of Pavia, in 1864, then Ambrosoli, of Milan, and Sigmund, of Vienna, used hypodermic injections of calomel, by means of a finely levigated powder held in suspension in water or in glycerin, in various syphilitic affections. Messrs. Riccordi, Monte Forte, Casati (1867), Max von Mons, Soresina, of Milan, Bertarelli (1879), Padova, Magri, Appiani, Ragazzoni, Fiorari, Profetà, Watraszewski (1884), have also used calomel by injections in syphilis. Maximum dose, ¾ grain.

Calomel, ...	2 grains
Glycerin, ...	up to 16 minims.

(*Scarenzio.*)

M. G. Smirnoff treated syphilis successfully by hypodermic injections of calomel. This author employed solutions of one-half the strength of those employed by Scarenzio and others with the object of avoiding abscess.

Calomel, ...	3 grains
Distilled water, Glycerin, ...	of each 56 minims
Calomel, ...	1½ to 2 grains
Powdered gum arabic, . . .	1 grain
Distilled water, ...	up to 66 minims.

Eight to sixteen minims contain ¾ to 1½ grains of the weaker preparation, and 1 to 2 grains of the stronger.

The results obtained in the treatment of syphilis were sat-

isfactory, but a small abscess frequently resulted at the point of puncture. A certain number of Italian physicians (Quaglino, Flarer, Magri, Gotti and Santini) used hypodermic injections of calomel in various ophthalmic affections of syphilitic origin. Messrs. Arigo, Formenti, Rossetti, Malvisi, subsequently used injections of calomel in pneumonia. According to Rossetti they should be made from the seventh to the tenth day in doses of ¾ grain to 2½ grains in mucilage.

M. Boni was much pleased with the results obtained by injections of calomel in croup; ¾ grain in the left arm of a child. ("Gazzetta med. Ital., provincie Venete," December 15th, 1883, p. 408.)

An important paper by Dr. Neisser on the value of calomel injections, published in the "Tageblatt der 58sten Naturforscher-Versammlung" in Strassburg, is quoted in the "London Medical Record" (Feb. 15th, 1886). Dr. Neisser recommends 4 to 6 injections, each containing 1½ grains of calomel prepared according to the subjoined formula:

Calomel,	
Sodium chloride, . . .	of each ʒ iv.
Mucilage of acacia, ...	ʒ ij.
Distilled water, ...	ʒ iss.

[It would be advisable to substitute mucilage of tragacanth for mucilage of acacia, as calomel is apt to cake with the latter and would thus be likely to choke the needle.—*Trans.*]

He concludes that injections of calomel, combined with mercurial inunction, constitute the most effective and energetic treatment of syphilis, and he is of opinion that this proceeding is the only one which insures the success of mercurial inunction. He thinks, from clinical experience, that the calomel method is most appropriate, and has proved most efficacious—(1) in the first treatment of syphilis; (2) in the treatment of serious relapses, both in their first and subsequent stages (iritis, squamous eruptions, etc.); (3) in the energetic curative methods which are to be repeated annually for 3 or 4 years. It appears that out of a total of 717 injections, there were 31 cases of abscess in 25 patients. Pain was, however, a more frequent occurrence, as was also stomatitis. In short, Dr. Neisser thinks that the advantages of the calomel method preponderate over its disadvantages.—*Trans.*]

HYDROQUINONUM.

HYDROQUINON. HYDROCHINON.

Hydrochinone is a benzol derivative, isomeric with pyrocatechin and resorcin. It is soluble in 18 parts of water, and easily in alcohol and ether; it is inodorous and has a sweetish taste.

Chief Physiological Effects.—Rapid fall of temperature, a dose of 3 grains producing an immediate fall of five-tenths. Doses of 6 to 9 grains produced this result with greater certainty and at the same time effected a diminution of the pulse. In doses of from 12 to 16 grains symptoms of excitement, resembling those produced by full doses of resorcin, were observed. These symptoms are transitory.

Its ready solubility and non-irritating character make hydroquinon suitable for hypodermic use, its injection never causing more pain than an injection of pure water.

Hydroquinon, ... 10½ grains
Distilled water, . . . up to 112 minims.
32 minims = 3 grains of the salt.

[As it requires 18 parts of water for solution, the proportions in the formula above given appear to be incorrect unless the injection is introduced warm.—R.]

After this injection a fall of 2° C. in the temperature, and of the pulse-rate by one-third, were observed, but these effects were very transient.

[In the article already quoted from the "British Medical Journal," it is stated that 3 grains of hydroquinon reduce the temperature very quickly without any unpleasant effects. The writer recommends that 5 to 10 minims of a 10-per-cent solution should be injected into each arm. An interesting paper by Dr. Seifert, of Dresden, in the "Berliner Klin. Wochensch.," 1884, No. 29, is quoted in the "London Medical Record," xii., 468. Dr. Seifert praises hydroquinon highly as an antipyretic, and says that no ill effects follow from repeated doses, so that fever may be kept down by it continuously and methodically. It has no disagreeable taste and is taken readily by children.—*Trans.*]

HYOSCINA.

Hyoscine and its Salts.[31]

[There has been considerable divergence of opinion as to the influence and mode of action of hyoscyamine, and it appears to be probable that many samples of so-called hyoscyamine have really owed their properties to the presence of unrecognized hyoscine. [This was pointed out in April, 1884 by the editors of the "American Druggist" (page 77). The so-called "Amorphous Sulphate of Hyoscyamine" which has a slight yellowish tint, consists largely of hyoscine, and is often used in place of the latter.—R.] To Ladenburg the merit is due of having been the first to isolate hyoscine and to describe its chemical and physical properties and its physiological action. As this drug is likely to take a foremost place among well-established hypnotics, and as only a passing notice has been taken of it as an anhydrotic by Drs. Bourneville and Bricon (which action, by the way, is questioned by Dr. Mitchell Bruce and other writers), it has been thought well to insert a notice of its properties and uses.

Hyoscine is a somewhat glutinous material and yields crystalline salts, the principal of these being the hydriodate, the hydrobromate, and the hydrochlorate. The experiments of Prof. Wood have been made with the two former, the hydrobromate being mostly used. [This is the preferable salt as it is in colorless, permanent crystals, and very soluble. The hydriodate is generally colored, and is much less soluble.—R.]

In frogs the symptoms produced were these: "An increasing sluggishness with a progressive loss of muscular movement, and a corresponding depression of the reflex activity; but without marked loss of sensibility. The respiration seemed to suffer *pari passu* with the general muscular power." When the dose administered did not produce lethal effects, there were no convulsive phenomena accompanying the restoration of muscular power, as is the case in frogs poisoned with atropine. Respiration failed before circulation, and even a strong solution of the alkaloid applied directly to the exposed heart exerted a slow and feeble depressing influence.

In the case of *mammals* hyoscine acts as a spinal depressant, and centric respiratory depressant, but it affects the

circulation slightly, and does not paralyze the pneumogastrics. In poisonous doses, although it paralyzes the vaso-motor system, it has very slight depressant influence on the heart. In the healthy human being the effects of a medicinal dose were as follows: In ten minutes after subcutaneous injection the symptoms resembled those of slight alcoholic intoxication, viz., sense of lightness and giddiness. These symptoms were succeeded by dryness of the mouth and throat, and restlessness in spite of the giddy sensations. Then followed drowsiness and profound sleep, on awakening from which there was no recollection. In one gentleman who accidentally took a small dose of a strong solution there were symptoms of weight of the eyelids, constrictive headache, chiefly frontal, sense of suffocation without dyspnœa, great uneasiness and unrest, with intervals of unconscious sleep. On recovery the after-effects were limited to slight headache and feeling of lassitude.

The *dose* ranges from $\frac{1}{200}$ to $\frac{1}{100}$ of a grain, and in some cases to as much as $\frac{1}{75}$ or $\frac{1}{50}$ of a grain. Dr. Mitchell Bruce has given as much as $\frac{1}{25}$ of a grain of the hydriodate without injurious effects, but as a general rule this dose is unsafe, and even with $\frac{1}{100}$ of a grain Dr. Nestor Tirard has observed, in a case of chronic Bright's disease, angry and combative delirium.

The drug is best administered hypodermically.

Hydrobromate of hyoscine, . .	1 grain
Distilled water, ...	200 minims.

One minim = $\frac{1}{200}$ grain.

M. Fräntzel has given the hydriodate of hyoscine in doses of from $\frac{1}{140}$ to $\frac{1}{48}$ grain and upward according to the following formula:

Hydriodate of hyoscine, . . .	1 grain
Distilled water, .	up to 2 ounces 160 minims.

Eight minims = $\frac{1}{140}$ grain.

This author recommends hyoscine in cases where atropine has failed.

Therapeutics.—Dr. Wood regards hyoscine as being of little use for the relief of pain, but of great value in the treatment of spasm. It is contra-indicated in patients with a tendency to pulmonary œdema.

Hyoscine is of great service in the treatment of delirium,

excitement, and insomnia, alike in insanity and other diseases. It has been found useful in controlling the spasms of *hydrophobia*, although it failed to cure the disease, in the delirium of *pneumonia, cardiac and renal disease, epileptiform convulsions and chorea.* Prof. Edlefsen administered it in six cases of *whooping cough*, with advantage in three cases; in six cases of *asthma*, always with advantage, and in two cases of severe *enteralgia* with relief of pain. It has been extensively used by alienists with unmistakable benefit in cases of *acute dementia, mania, melancholia, hystero-epilepsy*, and other mental diseases.

As Dr. Mitchell Bruce points out, hyoscine is only a temporary remedy to quiet delirium and control excitement, and it does not cure the various diseases in the course of which delirium arises.—*Trans.*]

HYOSCYAMINA. TINCTURA HYOSCYAMI.

Hyoscyamine. Tincture of Hyoscyamus.

Hyoscyamine is an alkaloid obtained from hyoscyamus or from belladonna. It is crystallizable. Of its salts only the sulphate is obtained in definite crystals. [According to the most recent researches, belladonna contains no atropine at all, but only hyoscyamine. According to the method of extraction, the latter is altered more or less to atropine. Both alkaloids have the same ultimate composition, but are nevertheless different. Hyoscyamine also constitutes a variable portion of the alkaloid daturine (see *Daturina*). In fact, there is an intimate relationship between a number of solanaceous plants (belladonna, hyoscyamus, stramonium, duboisia), which appear to contain varying proportions of the same alkaloids—possibly only *one*—which, by different methods of extraction have heretofore been obtained as mixtures, or in an altered condition.—R.] The physiological phenomena produced by it are identical with those of daturine (see Daturina), nevertheless there is this difference between the two alkaloids, that the former causes no intermittence or arrest of the heart, nor convulsions. Oulmont and Laurent, who made these observations, used Merck's brown liquid hyoscyamine, of a syrupy consistence. [This is no longer in the market. It was of very indefinite composition.—R.]

It induces carbuncles and emaciation. Elimination is rapid and chiefly by the kidneys. It is partially *antagonized* by physostigmine (Amagat).

Local Effects.—Nil.

Dose, $\frac{1}{100}$ to $\frac{1}{4}$ grain (!) daily. M. Pitha reports that after a dose of $\frac{1}{12}$ grain, he observed almost at once extreme bodily enfeeblement.

Hyoscyamine, ...	1 grain
Distilled water,	to 560 minims or 1120 minims.

(*Eulenburg.*)

[Hyoscyamine being almost insoluble in water, the pure crystallized *sulphate* should be used.—R.]

In the treatment of night-sweats of phthisis, and in one case of profuse perspiration after a paroxysm of intermittent fever.

Therapeutic Uses. — Mercurial, saturnine, alcoholic and senile tremors (Oulmont, Eulenburg); obstinate chorea (Richter); mania (Mendel, Reinhard, Gray, Sepilli, Riva and Richter); epilepsy (Reinhard, Laurent, Sepilli and Riva); neuralgiæ, sciatica, Eulenburg (solution 1 in 500—from $\frac{1}{100}$ to $\frac{1}{6}$ grain), and Simonowitch, both without success; Verneuil used it with success after resection of the nerve had failed to afford relief. Laurent has used it in hydrophobia (Milan Commission, 1864); it has been used in the period of excitement in general paralysis, in locomotor ataxy and sclerosis (Lawson); lumbago (Laurent); paralysis agitans (one-per-cent solution, Bourneville).

[For further details of the therapeutics of hyoscyamine, see a paper by Mr. Engledue Prideaux, L.R.C.P. (published in the "Lancet," 1884), who has used the drug extensively. He has administered it, both by mouth and subcutaneously, in cases of mania with changeable delusions, with marked benefit, in monomania and pure melancholia, without much benefit, and with good results in mania of suspicion, even if accompanied by depression, and in ordinary epilepsy. Mr. Prideaux finds that in delirium tremens it lessens the delusions and cuts short the attacks. He adds "that in all cases of mental excitement, including acute mania, hysterical mania, and puerperal mania, it is the only reliable hypnotic that we have got." He uses Merck's amorphous extractive in doses of from $\frac{1}{16}$ to $\frac{1}{2}$ of a grain according to circumstances.—*Trans.*]—[This "amorphous extractive," as pointed out under *Hyoscina*, con-

tains a large proportion of hyoscine, and the effects obtained by Prideaux were no doubt largely due to this. It is impossible to base any conclusions on any of the older reports regarding hyoscyamine, owing to the uncertain composition of this. And even in the case of recent writers, unless they particularly specify the kind of "hyoscyamine" used by them, much doubt often remains as to whether true hyoscyamine or hyoscine has been the active agent.—R.]

HYPNONUM.

Hypnone.

[This new hypnotic, chemically belonging to the class of ketones, which was first observed and reported upon by Dr. Dujardin-Beaumetz, is also known under the name of acetophenone, and is prepared either by the action of benzoyl chloride on zinc-methyl, or by distilling together benzoate and acetate of calcium.

Some experimenters state that in the system this ketone undergoes a chemical transformation into benzoic and carbonic acids and is eliminated by the urine in the form of hippurate. Dr. Dujardin-Beaumetz says of it, "administered to adults in doses of 2 to 4 drops, which correspond to 5 to 15 centigrammes, hypnone induces sleep, and in cases of alcoholism it has appeared to yield better results than either chloral or paraldehyde."

"When injected subcutaneously in guinea pigs, in doses of 8 to 16 grains of the crude drug, hypnone induces a condition of torpor deepening into coma, and the animal succumbs after 5 or 6 hours. Hypnone is a fluid at the ordinary temperature and possesses a powerful odor resembling at the same time that of cherry-laurel and of fresh hay." It is insoluble in water, but is miscible with alcohol, ether, and glycerin.

Dr. Savage, who has used hypnone in several cases, has not found any ill effects follow from its administration; it appeared to be useful in cases of active melancholy, "and in one case at least it appeared to check an attack of recurrent mania." He does not consider that it is adapted for hypodermic purposes. It appears to resemble urethane in being a pure hypnotic, and consequently is not calculated to be of much service as a sedative where there is pain.—*Trans.*]

ICHTHYOL.

Ichthyol. Sulphichthyolic Acid and its Salts.

The name of *ichthyol* was at first applied to sulpho-ichthyolic acid[32] prepared by treating with sulphuric acid an oil obtained by distillation from fossil bituminous deposits found near Seelfeld in the Tyrol. Introduced by Unna in the treatment of skin diseases, the same author has recommended it for some internal ailments, amongst others for acute and chronic rheumatism. Although it is chiefly used as an external application, it has been also used hypodermically in 16-minim doses of a 5 to 10 per cent aqueous solution.

[Ichthyo-sulphuric or sulph-ichthyolic (or more correctly, ichthyo-sulphonic) acid is little used at present, but the salts obtained from it are much employed. The name *ichthyol*, by common consent of the manufacturers and the trade, is now applied to the ichthyo-sulphate of *ammonium* (ammonium sulph-ichthyolate, ammonium ichthyo-sulphonate). Salts of sodium, lithium and other bases are also prepared.—R.]

Dr. Unna has also recommended hypodermic injections of sulpho-ichthyolate of sodium (2 per cent aqueous solution) in the treatment of lupus.

[Ichthyol contains nearly 11 per cent of sulphur, and is a powerful antiphlogistic, rapidly producing anæmia of all the tissues to which it is applied. It must not be applied to abraded surfaces. Internally it is best administered by the mouth in doses of ℥ ss. to ℥ i. for adults, and 3 to 6 grains for children.[33]

Dr. Unna says that ichthyol is indicated internally: "(1) In skin diseases, acne rosacea, nervous forms of eczema in persons of nervous constitutions; eczema from teething; lichen urticatus; erythema multiforme; dermatitis herpetiformis; furunculosis—but it is *not* indicated in psoriasis. (2) In the following other diseases (I speak after five years' experience): in acute and chronic rheumatism; bronchial asthma; chronic catarrh of the stomach and intestines, together with catarrh of the bile duct (icterus); chlorosis, tuberculosis (especially in children), and scrofula; vascular engorgements of all kinds." It is a paratriptic, the body weight increasing under its use.[34] —*Trans.*]

INJECTIONES HYPODERMICÆ NUTRIENTES.
Nutritive Hypodermic Injections.

Since the physiological researches of Messrs. Menzel and Perco (1869) on the absorption of alimentary substances by the subcutaneous tissue, several attempts have been made in this direction. *Cod-liver oil*, which was experimented with by Messrs. Mosler and Pick, produced symptoms of local irritation.

Injections of fluid fat, of various oils, milk, etc., are incapable of causing fat embolism. The experiments of M. Flournoy ("Contribution à l'étude de l'embolie graisseuse," Paris-Strasbourg, 1878) have proved that they are innocuous in this respect. It is true that M. Riedel has discovered fat emboli in the lungs, consequent on injections into the abdominal cavity. Oil which has been injected, except when the injection is made into the peritoneal cavity, is only absorbed after the lapse of a very long time, at least in the case of rabbits. See also the physiological experiments of M. Eichhorn ("Wien. Med. Woch."). M. Albertoni (1873) injected milk serum into the veins of dogs. About the same time Hodder in Canada practised transfusion of milk in four cases of cholera, with three recoveries. M. Miglioranza ("Gazz. Med. It. Lomb.," May 6th, 1883) found as a result of experimental researches that it was a mistake to propose transfusion of milk for that of blood; that in the treatment of cholera, transfusion of serum by Abertoni's plan might be adopted, but not that of pure milk; that in anæmia lacteal transfusion could never replace blood transfusion; and, moreover, that these injections produced serious and even fatal results.

See in connection with the subject of intravenous injections of milk, gelatin, serum, and egg albumen, the treatise of M. Calmette, "Recherches expérimentales sur l'albuminurie produite par l'injection de substances organiques azotées dans le sang" ("Archives de physiologie," tome iii., 1870–71, p. 26).

Sweet almond and olive oil have also been administered as nutritive agents (see Oils).

Solution of *sugar* has been used by Krueg in a case of insanity where nourishment was refused. An entire *egg*, the white and yolk being mixed, has been injected by Krueg, with

subsequent abscess. Pick injected the *yolk*. Whittaker has injected with success in a case of gastric ulcer, milk and beef juice alternately (one fluidrachm every two hours). M. Luton made injections of milk (one and a half drachms each) and in four instances phlegmonous abscess resulted. We may add that Pick also practised injections of milk. Intravenous injections of milk have been made by Hodder, of Toronto (1850), and later by Gaillard Thomas, etc.; but they are apt to be productive of various accidents, amongst others fatty emboli (Culurq, 1879).

Dr. Edward Warren ("The Treatment of Typhoid Fever," 1876) recommends hypodermic injections of diluted milk, both as an aliment and as an antipyretic.

Milk has besides been injected into the veins; this method, which appears to have been used chiefly in America, has been recommended as a substitute for transfusion of blood, but this question does not fall within the scope of our inquiry. (See the cases of Dr. Thomas, of New York, who used from ten drachms up to eight ounces with success, and others.) M. A. Voisin, in melancholia, and M. Bernutz, in two cases of gastric ulcer, injected—the former, sheep's blood, and the latter, dog's and chicken's blood. Subcutaneous injections of defibrinated blood have been administered, both in cases of defective nutrition and as a substitute for transfusion, by various authors; among others by Messrs. Karst, Landenberger, Bumüller, Camerer, Schmeltz, Nicaise, Fless, Barreggi, Casse, and Langlet.

Barreggi uses for this purpose a Pravaz syringe with a capacity of one fluid drachm, or an apparatus for continuous pressure. The injections should be repeated every five or ten days, and should be of considerable amount, from 3 to 9 fluidounces. The defibrinated blood is prepared from blood taken from the jugular vein in the horse, dog, or man. The globules were absorbed without alteration (?), and the results were superior to those obtained from peritoneal transfusion. The blood was enriched both in globules and in hæmoglobin ("Arch. It. Med.," quotation from the "Imparziale," 20th August, 1883). Paladini on two occasions injected 4 fluidounces, in two doses, of human blood (case of acute anæmia) into the subcutaneous tissue by means of an ordinary syringe, fitted with an elastic tube uniting it to a fine trocar, which he moved about laterally

to separate the meshes of the connective tissue. With the exception of some ecchymosis there was no local trouble. Cure followed.[35]

Prof. Ziemssen has recently recommended a somewhat similar method. He injects into each thigh six drachms and twenty minims of defibrinated human blood, by means of a special syringe of the same capacity. Systematic massage of the blood tumor is then made. The injections caused only a trivial amount of pain and no local reaction. Ponfick, in 1879, recommended peritoneal injections of blood; since that time they have been practised by several other authors (Golgi and Raggi used them in anæmia with profound syncopal attacks). The attempt to utilize hæmoglobin solution at a temperature of 94° proved a failure in the hands of M. Bernatzik, in consequence of the severe local troubles which resulted. We may mention, in conclusion, injections of blood serum (Hüter), and of sodium chloride (Lubanski, see SODIUM; saline transfusions have been successfully practised by Messrs. Bischoff, of Bâle, and others); and lastly, of the peptones (see FERRUM).

IODUM. IODI TINCTURA.

IODINE. TINCTURE OF IODINE.

Hypodermic injections of iodized water (S. Cézard, Jaillot, Collot, Chipault, Verneuil, Davaine, Raimbert, Rémy, Labbé, and A. Richet), or of pure tincture of iodine (Boinet, Th. Anger, and Coulom; these authors have not observed either abscess or phlegmon as a result of injection), have been used in the treatment of malignant pustule, but the mode of action and the operative procedure class these injections among those with a localized effect.

IODOFORMUM.

IODOFORM.

Insoluble in water, soluble in alcohol (1 in 50), in ether (1 in 6), in fats, volatile and fixed oils, vaseline, chloroform, and carbon bisulphide.

Chief Physiological Effects.—Local and general anæsthesia, antisepsis, vomiting, nausea, epigastric pains, diarrhœa

(Maillard, dose 7 grains). According to some authors, iodoform acts like iodine. In dogs, doses of about 75 grains produced convulsions and death; fatty degeneration of liver, kidneys, and pancreas. Elimination is effected by the kidneys.

Local Effects.—Slight pain, redness and induration. Solutions in oil give rise to a more decided local action.

Dr. Bozzi, of Milan, was the first (in 1870) to make use of hypodermic injections of iodoform.

Iodoform, ... 3 grains
Ether, . . . up to 20 or 32 minims.
One to two syringefuls.
(*Neumann. Jouon, of Nantes.*)

The ethereal solution of iodoform has been used with success in severe cases of arthritis by Messrs. Mikulicz, Neumann, Müller, etc.

Iodoform, ... 1 grain
Almond or castor oil, . . up to 16 minims.

M. Neumann, rejecting Thomann's diluted solution (5 per cent), made use of saturated solutions.

Iodoform, ... 1 grain
Castor oil, ... up to 16 minims.

Iodoform, ... 5 grains
Ether, ... up to 32 minims.

Iodoform, ... 3 grains
Ether, ... 15 minims
Olive oil, ... up to 32 minims.
Sixteen minims = 1½ grains.

Iodoform, ... 2 grains
Castor oil, ... up to 16 minims.

Iodoform, ... 6 grains
Glycerin, ... up to 24 minims.

[Iodoform being practically insoluble in glycerin, only a mechanical mixture can be made of these ingredients.—R.]

From his researches Prof. Neumann believes not only in the absorption of iodoform when dissolved in ether, etc., but also in its absorption when held in suspension in glycerin. Dr. Mrazek ("Anzeiger d. Ges. d. Aerzte," No. 27, 1882) has also used iodoform suspended in glycerin; its presence was detected

in the urine, but the process of elimination was slow, at the rate of 1½ grains per diem, 1½ drachms of iodoform having been injected in thirteen days. Microscopical observations made by the author (post-mortem) showed that the glycerin injection was not innocuous, but gave rise to a local inflammatory process.

The solutions should be freshly prepared and kept in dark bottles. Emulsions of iodoform with distilled water and glycerin (equal parts) and mucilage have been employed in parenchymatous injections by Messrs. Delbastaille and Troisfontaines in the clinic of M. Van Winiwarter, and did not cause irritation; but such injections do not come within the scope of our subject. Iodoform has been injected hypodermically in syphilis by Messrs. Bozzi, Thomann and Lopp, and Neumann. Iodoform, which was introduced in 1836, has been chiefly used internally and externally in goître, scrofula, rickets, syphilis, phthisis, anal fissure, prostatic enlargements, neuralgia (Dr. Moretin, 1853), uterine and mammary carcinoma (Demarquay), serous collections, chronic arthritis, glandular enlargements (Gubler), cancerous and venereal ulcers, to stimulate sluggish wounds, in varicose and phagedænic ulcers, rupia and ecthyma, inter-digital mucous gummata, suppurating buboes, moist gangrene, gunshot wounds (Féréol), chronic venereal ulcer (D'Amico), intermittent fevers (Knotts), toothache due to caries (Lailler, Marrotte, etc.). The use of iodoform has been revived at various times, among others in Paris in 1873, finally, it has been brought into use anew in the treatment of wounds and various surgical affections.

KAIRINA.

KAIRINE.

A derivative of quinoline, discovered in 1882 by O. Fischer. We understand by this name the hydrochlorate of oxy-ethyl-quinoline. [The name kairine was applied by O. Fischer to two synthetically prepared bases, derived from quinoline, one containing the *ethyl* and the other the *methyl* group. The former was at first designated by *kairine A* (the A standing for æthyl), and the second by *kairine M.* Subsequently, the ethyl kairine (kairine A) was exclusively used, and called simple *kairine.* — R.] Kairine hydrochlorate exists in the

form of a white, or whitish, crystalline powder, soluble in 6 parts of water and in 20 parts of alcohol, slightly soluble in glycerin, and insoluble in ether. It has a saline bitter taste.

Principal Physiological Effects.—Is an antiputrescent, slows the pulse and respirations, lowers arterial tension, and diminishes temperature by vaso-motor dilatation. There is diminution of general sensibility and motility in proportion to the amount of the dose; convulsions, contractures, pupillary contraction and paresis occur only after large doses. Profuse sweats coincide with fall of temperature and rigors with its rise; there may be cyanosis, hæmaturia, and diminished excretion of urea. The respiratory capacity of the blood is diminished (Picot, Brouardel, P. Loye, Conscience), reduction of hæmoglobin to methæmoglobin (Morohowetz, of Moscow, and Galoubof). *Elimination* is effected by the kidneys with dark-green discoloration of the urine.

Therapeutic Uses.—Kairine, although used in a great variety of affections by various authors (Filehne, Guttmann, etc.), has been almost exclusively used internally. M. Queirolo has, however, used kairine hypodermically in doses of 1½ to 8 grains in 16 minims of water. These injections did not give rise either to local or general ill-effects. The same author states that at the ordinary temperature kairine will only dissolve to the extent of 1½ grains in 16 minims of water. Stronger solutions can be prepared by gradually raising the temperature of the water, which will remain clear at a temperature of 95° F. Deep injection is necessary. Kairine has been mostly used as an antipyretic, but the unpleasant effects, such as profuse perspiration and rigors, to which it gives rise, and the very temporary influence it exerts on the temperature render it less useful as an antipyretic than antipyrine. In conclusion, it is contra-indicated in cardiac and pulmonary diseases, anæmia, and those ailments which are characterized by diminished hæmatosis and impoverishment of the blood. (Picot and Conscience.)

LITHII BROMIDUM.

Bromide of Lithium.

M. Lévy has experimented on himself with lithium bromide, in doses of ab. ¼ of a grain, but "although no local inconveni-

ence was occasioned, this mode of administration appeared to him to be useless and dangerous." Dr. Weir Mitchell has seen slight suppuration after injection of this salt.

MAGNESII CHLORIDUM.

Chloride of Magnesium.

M. Luton says he has accidentally used chloride of magnesium, produced by double decomposition by the action of morphine hydrochlorate dissolved in cherry-laurel water, the excess of acid being neutralized by the magnesia. "The contact of such a fluid with the tissues is scarcely perceived, it excites no irritation, and, what is more, it plays the part of a laxative. This effect very soon passes off, but it is incontestably manifested in some individuals. [Dr. Hay remarks on this subject —"saline purgatives do not act when injected subcutaneously; or, if they do, it is only when they are injected over the abdomen, and in virtue of a reflex effect." Von Ziemssen's "Handbook of General Therapeutics," vol. ii., 481.—*Trans.*]

MAGNESII SULPHAS.

Sulphate of Magnesium.

M. Luton has used sulphate of magnesium (1½ grains in 16 minims of distilled water) by the hypodermic method, and the purgative effect was produced. "This solution," he remarks, "is not irritating as has been asserted, or, at least, it does not cause more pain than pure water does."

M. Betz has used it and found it irritating. Gubler has used subcutaneous injection of sulphate of magnesium unsuccessfully (3 grains in 16 minims). Armaingaud (1877) injected it successfully.

MORPHINA.

Morphine and its Salts.

Morphine is almost entirely insoluble in water, sparingly soluble in alcohol, ether, chloroform, and glycerin, and insoluble in essential oils.

The *hydrochlorate* is soluble in 24 parts of water, in 50 parts of alcohol, and in 20 parts of glycerin.

Sulphate of morphine is soluble in 24 parts of water, and in 5 parts of glycerin. It contains 75.2 per cent of the alkaloid. The *acetate*, when freshly prepared, is soluble in 12 parts of water, but it is somewhat unstable; it contains 71 per cent of alkaloid. The *tartrate* is very soluble in water and alcohol; according to Stuart, who has recommended it for hypodermic use, it does not irritate the cellular tissue and is stable in aqueous solution. The *meconate* is almost gone out of use. [Recently, the *phthalate* has been recommended by Bombelon. This salt is soluble in 4 parts of water, forming a stable solution.—R.]

Principal Physiological Effects.—In *medicinal doses.*—In small doses, and even when the dose is considerable, the period of prostration is preceded by a stage of excitement, which, however, is very short in the latter case. Insomnia, excitement, and hallucination; increase of blood pressure and temperature, and increased rate of cardiac pulsations also result from these doses. Somnolence, muscular enfeeblement, sensorial troubles, contraction of the pupils, mental torpor, diminution of sensibility, and of muscular contractility, co-existing with increase of reflex excitability (the spinal cord is influenced by the morphine after the brain), dryness of the mouth and throat, with thirst, impairment of appetite and of gastric digestion, constipation, nausea, and vomiting, more or less profuse perspiration, itchings, excitement and alarm on awaking.

In larger doses[36] there are sluggishness of thought and of movement, succeeded by comatose sleep; the pulse is either slow or of unwonted frequency, respiration becomes irregular and sometimes falls in number to eight or ten per minute; the mucous membranes become cyanosed, the countenance is pallid and covered with violet colored patches. The temperature falls and death finally supervenes, frequently amidst clonic and tonic spasms. The local action of morphine hypodermically injected, although it appears to be tolerably certain, is still a matter of controversy.

Opium has a much more decidedly stimulating effect than morphine on the cardio-vascular apparatus; it raises the pulse, at the same time increasing the amplitude of the pulse wave, and it stimulates also in the most marked way the calorific function. The hypnotic phenomena produced by opium may be explained, according to many authorities, by a condition of

static congestion of the cerebral substance and the meninges; hence it has been proposed to utilize it and its derivatives to counteract the cerebral anæmia resulting from aortic insufficiency and other affections.

Morphinism.[37]—Dryness of the mouth, thirst, nausea, vomiting, generally constipation, occasionally dyspnœa and palpitation (a combination rare and unusual), albuminuria, loss of power, amenorrhœa, insomnia with hallucinations, varying disposition, hyperæsthesia, neuralgia, tremor of hands, bewildered and stupid expression; various forms of eruptions, loss of appetite, tendency to suppurations, emaciation. These phenomena are more pronounced after the sudden abandonment of the morphine habit. M. Luton, following the practice adopted by certain physicians and hospitals in New York, is in favor of the sudden cessation of morphine injections; in addition to an appropriate hygiene, he recommends nux vomica preparations and derivatives, as a remedy for morphinism as well as of alcoholism. (See also Bourneville and Regnard, "Icon. phot. de la Salpêtrière," tome iii., p. 93.)

The combined action of *morphine* and *chloroform* was observed almost simultaneously by Neumann and H. Bernard. Morphine administered before chloroform induces profound muscular relaxation; given afterward, it prolongs the chloroform anæsthesia. Numerous surgeons have used it with benefit in combination with atropine before anæsthetizing. (See ATROPINA.)

The subjoined table shows readily the relative position as hypnotics, convulsants, and toxic agents of the various alkaloids of opium.

Hypnotic Action.—(1) Narceine. M. Fronmüller and some other authors attribute only the slightest hypnotic effects to it. In man according to Rabuteau, it is less of a soporific than morphine. (2) Morphine, (3) Codeine. M. Rabuteau, in opposition to the opinion expressed by M. Bouchut, regards this as soporific and analgesic to a very trifling extent; in man it does not appear to be poisonous except in doses above 2¼ grains.

Tetanic Action.—(1) Thebaine; (2) Papaverine; (3) Narcotine; (4) Codeine; (5) Morphine; (6) Narceine.

Poisonous Action.—(1) Thebaine; (2) Codeine; (3) Papaverine; (4) Narceine; (5) Morphine; (6) Narcotine.

Man is of all animals most sensitive to the action of morphine, and hence it is necessary to be on one's guard, more perhaps than in the case of any other drug, against the error of judging the effects likely to arise in him from those which are manifested in the lower animals. Besides, in man and the lower animals, alike, the effects vary with age, constitution, etc. Children, for instance, are extremely susceptible to the influence of morphine. The lethal dose in individuals who are not habituated to its use varies within very wide limits; hence it is wise to begin with very minute doses ($\frac{1}{10}$ grain for example), and to increase them cautiously. Morphine is *eliminated* with considerable rapidity by the kidneys. As regards the question of *antagonism* between opium and its salts on the one hand and atropine and daturine on the other, it is very open to question. The *local effects* are *nil* when the injection is skilfully effected.

Rynd was the first who administered morphine subcutaneously (with creosote as a vehicle), and he was followed by Wood, Béhier, etc. Solutions of morphine hydrochlorate become turbid very quickly, and become possessed of irritant properties. To obviate this difficulty cherry-laurel water has been proposed as a vehicle, as have also water distilled from eucalyptus globulus (Gubler), peppermint and cinnamon water (Delioux and Savignac), glycerin, alcohol, alcohol and water (Adrian and C. Paul), distilled elm water (Patrouillard), chloral (Vidal), a solution of salicylic acid, 1 in 2,000 (Limousin, Keyes, etc.), carbolic acid, etc. [The best preservative, in the case of hypodermic solutions of alkaloids, and especially of morphine salts, is chloroform water, prepared by saturating distilled water with chloroform by shaking. One grain of chloroform will dissolve in about 200 grains of water.—R.]

We always think it desirable, whatever vehicle may be selected, to use a one or even a half per cent solution. The solution may besides be freshly prepared, as required, with advantage.

Hydrochlorate of morphine, .	$\frac{1}{2}$ to 1 grain
Distilled water, .	up to 112 or 224 minims.

Sixteen minims represent $\frac{1}{14}$ to $\frac{1}{7}$ grain.

Hydrochlorate of morphine, . .	2 grains
Chloral, ...	4 grains
Distilled water, . .	up to 112 minims.

M. Vidal finding that this solution caused pain reduced the proportion of chloral to ½ grain.

Hydrochlorate of morphine, . . 1 grain
Cherry-laurel water, . . up to 56 minims.
Eight minims contain ¼ grain.

Messrs. Savory and Moore's discs contain ¼ grain of morphine; they are perfectly soluble in a few drops of warm water. Numerous authors have pointed out the happy effects of combining morphine with atropine. (See ATROPINA.)

Hydrochlorate of morphine, . . 1 grain
Sulphate of atropine, . . . $\frac{1}{10}$ grain
Cherry-laurel water, . . up to 224 minims.

Sixteen minims of this solution contain $\frac{1}{14}$ of a grain of morphine, and $\frac{1}{140}$ of a grain of atropine.

Acetate of morphine, . . . 12 grains
Acetic acid, ... 1 minim
Glycerin, ... 5 minims
Distilled water, ... up to 36 minims.
(*Nider.*)

[This formula appears to be erroneous, as Messrs. Bourneville and Bricon observe, and should be stated as follows:—

Acetate of morphine, ... 12 grains
Acetic acid, ... 1 minim
Glycerin, ... 5 minims
Water, ... up to 240 minims.

This solution contains 1 grain, instead of 6.9 grains, in 20 minims.—*Trans.*]

Hydrochlorate of morphine, . 1 grain
Spirit of peppermint, . . . 10 minims
Peppermint water, . . up to 112 minims.
(*Delioux and Savignac.*)

Sulphate of morphine, . . 256 grains
Salicylic acid, ... 8 grains
Distilled water, ... 16 fl. ounces.

Heat the water to the boiling point, dissolve the morphine and salicylic acid in it and filter.
(*Keyes*, 1879.)

Sulphate of morphine, . . . 16 grains
Distilled water, . . . up to 480 minims.
Dissolve and filter.
(*Bartholow.*)

Sulphate of morphine, . . .	16 grains
Sulphate of atropine, . . .	½ grain
Glycerin, ...	1 drachm
Carbolic acid, ...	6 grains
Distilled water, ...	7 drachms.

Dissolve and filter. 1 grain of morphine and $\frac{1}{4}\frac{1}{8}$ grain of atropine in 30 minims. (*Sledge.*)

White oxide of antimony, . .	10 grains
Morphine hydrochlorate, . .	2 grains
Cherry-laurel water, . .	up to 112 minims.

Eight minims contain ¼ of a grain of morphine. To allay cough. (*Navarret.*)

[White oxide of antimony is entirely insoluble in water, and if suspended in the liquid, is very apt to clog the canula of the syringe. It is doubtful whether this mixture was ever really used hypodermically.—R.]

Sulphate of morphine, . . .	10 grains
Distilled water, . . .	q. s.
Diluted sulphuric acid, . . .	1 minim
Carbolic acid, ...	2 grains
Glycerin, ...	60 minims.

Filter. (*Ainsworth.*)

[There is no need of adding an acid to promote solution in the case of sulphate of morphine.—R.]

Dissolve the morphine in 180 minims of water with the diluted sulphuric acid by the aid of a gentle heat; then add the carbolic acid dissolved in the glycerin. Filter and add water up to 300 minims. Five minims contain ⅛ of a grain of morphine. The injection should be made intramuscularly. This solution frequently causes suppuration.

M. Rusconi has combined cocaine and morphine:

Hydrochlorate of cocaine, .	1½ to 3 grains
Hydrochlorate of morphine, . .	1 grain
Distilled water, . . .	up to 224 minims.

Sixteen minims contain $\frac{1}{14}$ of a grain of the morphine and $\frac{1}{16}$ to ½ of a grain of the cocaine salt.

The use of morphine has become so extensive and universal that it is administered nowadays in all sorts of ailments,

rightly and wrongly. We do not deem it necessary to dwell at greater length on the physiology and therapeutics of morphine and its salts, as they are so well known to, and in such general use by all practitioners. We may refer for further details of the hypodermic uses of this alkaloid to the monograph by Dr. Kane, of New York, "The Hypodermic Injection of Morphia, its History, Advantages, and Dangers," New York, 1880. We may further refer to the essay by M. A. Dennis, of Strasbourg (1868), which contains a well-constructed table of the diseases treated by morphine injections, with the names of the authors who have used them. This table, which is now out of date, consists of no fewer than six quarto pages. It is impossible to protest too strongly against this abuse, as morphine and its salts should never be prescribed except in well-defined cases. Morphine injections have frequently been used in the treatment of cholera. M. A. Renault, and more especially M. Huchard, have recommended the use of morphine in all forms of dyspnœa without any reference to their cause. Dr. Walter Coles, of St. Louis, recommended them in 1883; mophine before the period of collapse, combined with atropine in the intermediate stage, and atropine alone in the stage of collapse. Morphine and narceine alone of all the alkaloids of opium are anexosmotic; the former is specially serviceable in hypodermic injections (Béhier, C. Codrescu (1866), Vulpian, Legagneur (1876), etc.

[The Injectio Morphinæ Hypodermica of the British Pharmacopœia (1885) is a solution of the acetate; ten minims = 1 grain of the acetate, and the dose is 1 to 6 minims.

Martindale and Westcott give a formula for a solution of the acetate having a strength of 1 in 6. They also give a formula for a solution of the acetate in combination with sulphate of atropine, 3 minims of which contain ½ a grain of acetate of morphine and $\frac{1}{60}$ of a grain of sulphate of atropine. I have now for some time used Burroughs and Welcome's tabloids, which yield excellent results and are convenient in many ways.

The bimeconate of morphine was recommended by the late Mr. Squire ("Companion to the Pharmacopœia," 13th edit., p. 228). It is one of the least irritating solutions for hypodermic purposes, but has the disadvantage of readily becoming turbid. The tartrate of morphine is excellently adapted for

hypodermic use and is not so apt to corrode the needle as some other preparations. Like the bimeconate, it has the further advantage of not being apt to produce headache, nausea, or constipation.

[See remarks on page 452 on phthalate of morphine, which appears to have still greater advantages.—R.]

Among the many diseases in which morphine has been used subcutaneously, *diabetes* should be mentioned. The value of opium in the treatment of this disease has been known for a long time, and its employment hypodermically has been advocated for many years; but Dr. Mitchell Bruce has recently conducted some important clinical investigations which seem to prove that morphine may be used hypodermically in diabetes for diagnostic purposes—*i.e.*, to ascertain the particular form of the disease and the source from which the sugar is derived.

Dr. Bruce treated a case of glycosuria (1) on ordinary diet, (2) on strict Pavy diet, (3) on Pavy diet with the administration of morphine by the mouth, and (4) on Pavy diet combined with the subcutaneous administration of morphine. During the continuance of these experiments daily observations were made as to the amount of sugar excreted, and Dr. Bruce arrived at the following conclusions:

I. *Therapeutical.*—That morphine was of signal value in the treatment of diabetes.

II. *Physiological and Pathological.*—1. That in the particular case reported on, the glycosuria was proved to be due to an increased income of sugar into the blood, not to diminished destruction of sugar in the system.

2. That in the same case the increased income of sugar was proved not to originate in simple transportation of sugar from the intestine or portal vein to the general circulation.

3. The excessive glycogenesis in this case was proved to be effected mainly or entirely in the liver, not in the muscles or any of the other viscera.

4. The seat of the disordered process, whatever may have originated it, was shown to be in the liver, and not in the central nervous system or nerve trunks.

The importance of these observations and their direct bearing upon the subject of hypodermic medication are so obvious that no apology is, perhaps, required for quoting them at such length.—*Trans.*]

MOSCHUS—TINCTURA MOSCHI.

Musk, Tincture of Musk.

M. Rosenthal praises musk highly as a diffusible stimulant in the algid stage of cholera and in adynamic forms of typhoid fever. M. Rohde used an aqueous infusion (1 in 40), of which he injected from 16 to 48 minims *per diem*, according to the gravity of the case. In most of the cases a rise of pulse-rate and of temperature resulted.

Locally he observed on one occasion a slight slough of the skin in a case of cholera, and in another instance there was induration without abscess. M. Drasche obtained only negative results in the treatment of cholera. Musk and its tincture have lately been used by various writers, among others by Vogelsang, in the treatment of infantile convulsions. Tincture of musk is injected in doses of 8 to 32 minims. [This refers to the tincture of the German Pharmacopœia which is made with one part of musk and twenty-five parts each of water and alcohol. The French tincture is much stronger: the tincture of the *Codex* is composed of ten parts of musk to one hundred parts, by weight, of alcohol. The tincture of the U. S. Pharm. (1880) is also 10 per cent.] The practical value of musk is open to question, inasmuch as it is very costly, and its place is easily supplied by other stimulants.

MUSCARINA.

Muscarine.

Muscarine, an alkaloid extracted from the poisonous fly agaric, *Amanita muscaria* Persoon, has been used hypodermically only by Ringer and Morshead, who gave it in doses of ½ to ¾ of a grain. [For full details of Dr. Ringer's investigations see his "Handbook of Therapeutics," 12th edit., p. 368. He states that the action of muscarine is identical in men and in animals, that it contracts the pupil, excites profuse perspiration, free salivation, and running at the nose and eyes; it purges, occasionally causes nausea and vomiting, and excites a strong desire to urinate. Its properties are closely analogous to those of pilocarpine. It has been used with success in the night sweats of phthisis, and it as also been administered to

arrest the secretion of milk. See also the "Transactions of the Medical Congress," 1881, vol. i., p. 508.—*Trans.*] M. Prévost has suggested that it might be possible to antagonize the poisonous symptoms due to atropine by hypodermic injections of muscarine, physostigmine, or pilocarpine in moderate doses. We may add that M. Prévost's experiments prove a mutual antagonism between muscarine and atropine.

NAPELLINA.

NAPELLINE.

Napelline which has been investigated by Messrs. Hübschmann and Groves, who gave it its name, is contained in the mother-liquors of crystallized aconitine. It has been extracted by Duquesnel, is an amorphous alkaloid of aconite, is soluble in water, ether, alcohol, and to a slighter degree in chloroform. [It is very probable that napelline is a product, caused by some alteration of original aconitine during the process of preparation. It is by some believed to be identical with aconine, a decomposition product of aconitine.—R.]

"The great solubility of our napelline," observe Messrs. Duquesnel and Laborde, "has permitted our preparing a very clear solution, eminently suitable for subcutaneous injections." From their experiments they conclude that the effects of their napelline demonstrate: (1) that the phenomena by which it manifests its action are, in reality, fundamentally identical with those which are characteristic of the physiological action of crystallized aconitine. (In addition to a calmative and analgesic action, however, it is also soporific); (2) that the intensity of this effect is incomparably less than that of crystallized aconitine. From a dose of 16 grains, administered to a dog, Messrs. Duquesnel and Laborde obtained lethal toxic effects without emesis.

Napelline, ...	1 grain
Distilled water, ...	up to 112 minims.

Sixteen to sixty-four minims = $\frac{1}{7}$ to $\frac{4}{7}$ of a grain of the active substance.

Calmative and soporific effects were produced by doses of $\frac{1}{7}$ to $\frac{4}{7}$ grain, which were not succeeded on awaking by any sensation of illness (malaise).

M. J. Voisin has injected it hypodermically in several cases of epilepsy. His formula is:

Napelline, ...	1 grain
Alcohol (90%), ...	48 minims
Distilled water, . . .	up to 112 minims.

Napelline has been used in the clinic of M. Dumontpallier in facial neuraglia, in a hysterical patient, in neuralgic lumbago, and sciatica, in rheumatoid pains, and fugitive neuralgiæ, in doses of $\frac{1}{4}$ to $\frac{3}{4}$ of a grain in a 1 in 20 solution. We are of opinion that further experiments must be made before admitting this so-called alkaloid into our list of therapeutic agents. It is with this substance as with many others, we have not deemed it right to pass it over in silence; but such agents can only be accepted after extended investigation. [It might be well to experiment rather with the secondary alkaloid *aconine* mentioned in a preceding note. This is at least a perfectly definite chemical substance, while *napelline* has not yet been shown to be such.—R.]

NARCEINÆ HYDROCHLORAS.

Narceine Hydrochlorate.

Narceine is almost insoluble in water, is insoluble in ether, but readily soluble in alcohol.

The *hydrochlorate* dissolves readily in water, splitting at the same time up into a basic salt and free acid, but the sulphate is but little soluble in this vehicle.

Dose.—One and a half to three or even to six grains.

Narceine hydrochlorate, . . .	2 grains
Distilled water, . . .	up to 224 minims.

Dose.—Six, eight, twelve, or even as much as sixteen minims $\frac{1}{18}$, $\frac{1}{14}$, $\frac{1}{9}$ and $\frac{1}{7}$ of a grain respectively. ("Pharmacopœia of Vienna Hospitals.")

M. Rabuteau (1883) recommends injections of narceine hydrochlorate to obtain complete narcosis from small doses of chloroform. According to this writer, thebaine, and papaverine also, to a certain extent, promote chloroform narcosis.

Messrs. Béhier, Linné (1865), Erlenmeyer, May Figueira, Reissner, Piedvache, Oettinger, Petrini, Eulenburg, Fronmüller, Harpprecht, Lubanski and others have administered hy-

podermically both narceine ($\frac{2}{3}$ of a grain in 16 minims) and its hydrochlorate. A solution of narceine cannot be used cold, and its injection is sometimes attended with pain, as it is necessary to acidulate the solution.

M. Lubanski has suggested a combination of morphine and narceine injections in the subjoined formula:

Hydrochlorate of morphine, . .	1 grain
Distilled water, . . .	up to 24 minims.

To this may be added $1\frac{1}{2}$ to 3 minims of a ten-per-cent solution of narceine. ["The advantage of this is very doubtful." Eulenburg in Ziemssen's "Handbook of General Therapeutics," Dr. Hay's translation.—*Trans.*] Such a solution is as questionable in regard to composition as it is in regard to utility. If it is made use of at all, the solution should be made with hydrochlorate of narceine on account of its solubility.

NARCOTINA.

Narcotine.

Narcotine is insoluble in water and alkaline solutions, but soluble in 100 parts of alcohol, 33 parts of ether, and 3 parts of chloroform. *In small doses* it produces narcotic and soporific effects, and *in large doses* twitchings, convulsions, and, at last, general paralysis and death. It takes a larger dose of narcotine than of morphine to produce soporific effects. Writers are not agreed as to the dose which may be given, and there is a similar disagreement in regard to its physiological action;—thus M. Rabuteau denies that it has any analgesic or soporific action. This alkaloid has been administered hypodermically by Prof. Eulenburg [who says that both thebaine and narcotine are quite worthless for hypodermic as they are for any therapeutic use. — Loc. cit., p. 457.—*Trans.*] Injections occasion severe smarting, which, however, rapidly disappears.

NICOTINA.

Nicotine.

Nicotine, never previously used therapeutically, was employed hypodermically by Erlenmeyer in a case of tetanus,

without local trouble and with good results, in doses of $\frac{1}{10}$ of a grain.

Nicotine, ... 1 grain
Distilled water, . . . up to 280 minims.
Four minims = $\frac{1}{10}$ of a grain.

NITROGLYCERINUM. GLONOINUM.

Nitroglycerine or Glonoin.

Nitroglycerin or glonoin, which was discovered by Sobrero in 1847, is a nitric ether of glycerin; in its pure state, it is an inodorous, yellowish oil and has a mawkish taste; it is slightly soluble in water, but dissolves readily in alcohol and ether.

Principal Physiological Effects in Man.—Nitroglycerin is a powerful poison.

In moderate doses, 1 to 10 drops of a 1 per cent solution, it produces a feeling of intracranial fulness, more or less severe headache, confusion or sluggishness of thought, tinnitus aurium, vertigo, amblyopia, quickening of pulse rate with occasional dicrotism, diminution of arterial pressure, redness and flushing of the face, sweats, nausea, vomiting, and occasionally exaggeration of the respiratory movements.

In Poisonous Doses (exceeding ten drops) clonic and tonic convulsions and death from asphyxia. The effects of glonoin closely resemble those of amyl nitrite, but are more persistent. Most investigators have obtained merely negative results in animals. Indeed the effects of glonoin vary widely with the species of animal, its age, etc.; moreover, the physiological properties have long been a matter of uncertainty and dispute.

Messrs. Dujardin-Beaumetz and Marieux have injected 1½ to 3 minims of a 1-per-cent solution of nitroglycerin mixed with water up to 16 minims.

Alcoholic solution of nitroglycerin
(1 per cent), ... 25 minims
Cherry-laurel water, . . up to 160 minims.
(*Marieux and Dujardin-Beaumetz.*)
Sixteen minims = 2½ minims of solution of nitroglycerin.

[The above-mentioned alcoholic solution contains 1 per cent

by weight of nitroglycerin. As alcohol has a low (0.820), and glonoin a high specific gravity (1.600), the relation by *volume* in this 1 per cent solution differs greatly from that by weight. One minim of the 1-per-cent solution (made by weight) contains about $\frac{1}{11}$ minim of pure glonoin. On Solution of Nitroglycerin see the "National Formulary," under No. 341.—R.]

The effects are produced in from 5 to 10 minutes after injection. The dose should commence with two minims and should never exceed six minims in the twenty-four hours. By taking the precaution to make the injections into the muscles of the back or of the gluteal regions, these authors have never observed local accidents—such as pain or abscess.

Therapeutic Uses.—Nitroglycerin has been administered internally by Field ("Medical Times and Gazette," 1858) for neuralgia, epilepsy, and hysteria. Thorowgood and James, Laurence of Brighton, Baker Edwards, S. Brady (1859) and others have administered and recommended it. In consequence of the experiments of Fuller, Harley, and Vulpian (1859), who disputed the results obtained by the above-mentioned authors, glonoin fell into disrepute for several years, but after the publication of M. Bruel's essay, glonoin was again used by Murrell (1879), Mayo-Robson, Craig, Farquhar, Stilts, McCall Anderson, Green, Hammond, Steward, Korcinski, Huchard, Trusevich, and Bramwell, in angina pectoris, acute and chronic nephritis, epilepsy, eclampsia, asthma, palpitation, affections of the heart and aorta, syncope, migraine, neuralgia, vertigo, Menière's disease, and epileptiform tic.

In regard to some of these ailments, the results obtained are contradictory. Glonoin appears to be mostly of use in angina pectoris and in all diseases in which cerebral anæmia is a leading symptom. Quite recently M. Rossbach has recommended its use in the treatment of interstitial nephritis.

[The following formula is borrowed from the "Extra Pharmacopœia" of Messrs. Martindale and Westcott:

Solution of nitroglycerin, 1 per cent,	5 drachms
Alcohol, ...	2 drachms
Distilled water, . . .	up to 1½ ounces.

Dose 1 to 4 minims. One minim contains $\frac{1}{210}$ of a grain.

A very convenient mode of administration is by means of troches, tablets or pills [see "Nat. Formulary," No. 296—R.].

In addition to the diseases mentioned by the authors, nitroglycerin has been used with marked benefit in the treatment of sea-sickness, the vascular tension which occurs in the aged, myxœdema and puerperal convulsions.—*Trans.*]

OLEANDRINA.

Oleandrine.

This alkaloid, extracted from rose laurel (*Nerium Oleander*, belonging to the cardiac poisons) has been administered subcutaneously only by Erlenmeyer, but without success, in epilepsy.

Oleandrine, ...	10 grains
Alcohol, ...	q. s.
Distilled water, . . .	up to 120 minims.

12 minims = 1 grain.

[Oleandrine, an alkaloid discovered by Lukomsky, is to be distinguished from oleandrin, a glucoside, isolated by Schmiedeberg. As it is impossible to ascertain which of these bodies has been used by Erlenmeyer, no reliance can be placed upon any results reported by him, even if they had been positive.—R.]

OLEUM AMYGDALÆ EXPRESSUM.

Expressed Oil of Almonds.

According to M. Binz this oil has been used subcutaneously as a nutrient injection, but without success on account of the difficult absorption of oils by the cellular tissue (see *Injectiones Nutrientes*).

[Dr. Shoemaker, of Philadelphia, has used oil subcutaneously in numerous cases with most encouraging results. He has obtained the purgative effects of castor oil after hypodermic administration, and he has injected one to four drachms of cod-liver or olive oil in cases of debility, dyspepsia, scrofula, and in cutaneous and nervous diseases. In diseases of the alimentary canal and in all forms of defective nutrition this method of treatment has been eminently successful. As in most other cases of hypodermic medication, no evil results ensue from the practice, and beyond trifling and transient

pain, and perhaps a little local redness and swelling, no inconvenience is experienced by the patient.[38]—*Trans.*]

OLEUM OLIVÆ.

Olive Oil.

(See also the section on *Nutritive Injections*).

Krueg[39] has injected four to eight drachms of olive oil per diem in the case of a lunatic who refused food. The injection fluid being expelled slowly caused no pain and left only a trifling redness.

OLEUM TEREBINTHINÆ.

Oil of Turpentine.

Pure oil of turpentine has been administered hypodermically in doses of 16 minims by M. Luton, but without success, in a case of obstinate sciatica. The injection caused intense pain and was followed by abscess. Turpentine injections have been used successfully in the treatment of carcinomata, sarcomata, and other neoplasms by Vogt, but they are included in the class of interstitial injections which do not fall within the scope of our inquiry.

OLEUM TIGLII. OLEUM CROTONIS.

Croton Oil.

Béhier injected into the thigh one drop of croton oil to obtain its purgative action. No purgative effect was induced, and there was local sloughing. We may observe that Langenbeck has inserted croton oil under the skin without producing diarrhœa, and that it has also been used hypodermically in the treatment of erectile tumors.

OPIUM.

Opium.

Opium in aqueous solution (Lobl), the extract (Lebert), and the tincture of opium (Wood, Hunter, V. Franque, etc.), have been exhibited hypodermically (Eulenburg), but they are now quite abandoned. Opium is chiefly indicated in the treatment

of diarrhœa, in which disease it appears to be a more efficient remedy than morphine.

PAPAVERINA.

Papaverine.

Papaverine has been used hypodermically by Messrs. Leidesdorf and Schüle in cases of insanity, in the form of hydrochlorate or phosphate (six to twelve minims of a 1-in-12 solution of the salt).

The phosphate of this alkaloid produced abscess and sloughing.

PARACOTOINUM.

Paracotoin.

Paracotoin, which was isolated from Paracoto bark (of undetermined origin) in 1876 by Messrs. Jobst and Hesse, exists in the form of a yellowish-white crystalline powder, with an insipid taste and a peculiar, slightly balsamic odor. Slightly soluble in water, it dissolves in boiling alcohol, is sparingly soluble in cold alcohol and in boiling water, and is insoluble in ammonia (Wurtz). The physiological effects of paracotoin are identical with, but less pronounced than, those of cotoin (see this).

The method of using it is the same as in the case of cotoin; it has been used subcutaneously by M. Balz in the treatment of cholera.

The only drawback to the use of paracotoin is its sparing solubility in water. The best solution is one made with equal parts of glycerin and water.

PARALDEHYDUM.

Paraldehyde.

Paraldehyde is a polymeric modification of aldehyde. [That is several molecules—in this case three (3)—of ordinary aldehyde (C_2H_4O) have united to form *one* molecule of paraldehyde.—R.] It is soluble in water (1 in 10), less soluble in hot water than in cold, and is used in the same way as syrup of chloral. Introduced into therapeutics by Messrs. O. Berger, Morselli, and Bergesio, it is a hypnotic in doses three times as

large as that of chloral. According to M. Peretti it exercises no injurious action on the heart even in large doses; the hypnotic effect is produced rapidly, without a stage of excitement or of congestion. The number of pulse beats is generally diminished. The respiratory movements are slowed down, the temperature falls, and the secretion of urine is diminished (?). Nausea, vomiting, and vertigo have sometimes been observed after its administration. In large doses, sensibility and reflex movements are abolished, and death takes place from arrest of respiration. It exerts its action on the cerebral hemispheres, the medulla, and the spinal cord. There is an *antagonism* between strychnine and paraldehyde. (Dujardin-Beaumetz.)

The physiological action of paraldehyde has been fully investigated by M. Cervello (1883) in the laboratory of M. Schmiedeberg, and since then by various authors, viz., Messrs. Albertoni, Frederici, Quinquaud, Hénocque, Bochefontaine, Prévost, and Coudray, who mostly confirm the results obtained by Cervello. Nevertheless, some of the results are matters of controversy, especially as regards the action of paraldehyde on the blood.

At first used as a hypnotic, it has been lately used as a sedative in mania, melancholia, etc., by numerous authors (Morselli, Peretti, Berger, Langreuter, Masius, etc.). M. Kêraval was the first to use it hypodermically.

Paraldehyde,
Cherry-laurel water, . . of each 10 minims
Distilled water, ... up to 40 minims.
(*Kéraval.*)

It is necessary before using this solution to take the precaution of plunging it into hot water, not that heat increases the degree of solubility, far from it, but because by preventing crystallization of the paraldehyde, it insures its being kept in a fluid condition and, consequently, its thorough admixture with the vehicle. By this expedient it is possible to administer 16 minims (= 4 minims of paraldehyde).—P. Kéraval.

Paraldehyde, ... 56 minims
Spirit of peppermint, . . . 1 minim
Olive oil, ... to make 112 minims.
(*Langreuter and Strubisch.*)

PEREIRINA.

Pereirine.

Pereirine is extracted from the *Pao-pereira*, the bark of *Geissospermum lœve* Baillon, which has been used for a very long time (it was used in 1838 by M. Correia, of Los Santos, Brazil, who gave it its name) on account of its tonic, febrifuge and antiscrofulous properties, in a great variety of diseases. M. Freire, of Rio de Janeiro, investigated it with great care in 1879. It appears in the form of a yellowish, non-crystalline, inodorous powder, has a bitter taste, is sparingly soluble in water, but dissolves in ether, alcohol, and chloroform. The pereirine of commerce is an impure product. Of its salts, the hydrochlorate, sulphate, and valerianate are the only ones which have, as yet, been used therapeutically.

For hypodermic purposes the neutral hydrochlorate alone is capable of being used with advantage; it crystallizes in quadrangular prisms of a vermilion tint. It does not dissolve in ether, but is soluble in all proportions in water. Pereirine and its salts have an intensely disagreeable bitter taste.

According to Messrs. Cypriano Freitas and Bochefontaine, pereirine has no local irritant action and abolishes the functional activity of the central gray nervous substance, and more especially of the gray matter of the medulla and spinal cord (abolition of voluntary movements, afterward of the reflexes, and finally of the excitability of the motor and sensory nerves).

M. Lacerda drew the following conclusions from his physiological experiments: (1) That the hydrochlorate of pereirine in poisonous doses paralyzes the vaso-motor centres in the bulb, as well as the cardiac fibres of the vagus; (2) that it does not possess any antithermic action, but that, on the contrary, it increases the temperature by several tenths of a degree; (3) that this salt does not appear to exert any action on the secretions, and that it does not directly modify the properties of muscular fibre or the excitability of the motor nerves; (4) that its action on the heart is antagonistic to that of digitalis.

Hydrochlorate of pereirine, . 1–2 grains
Distilled water, . . . up to 24 minims.
Sixteen minims = ⅔–1⅓ grains.

(*Almir-Nina.*)

Hydrochlorate of pereirine delays fermentation (Almir-Nina). According to the same author the action of pereirine on the temperature is still an open question.

In *medicinal doses* pereirine gives rise neither to intellectual nor to sensorial troubles; its influence on the circulation is trifling and irregular.

The dose is 16 minims of the solution in each arm. This solution produces only slight inflammatory phenomena (redness, pain either spontaneous or excited) which disappear quickly. In no case have scars been produced.

Therapeutic Uses.—Pereirine and its salts, which have been mostly used in intermittent fevers (15 grains per diem, 1½ to 6 grains subcutaneously), have also been tried, but so far without any decided results, in the treatment of pernicious fevers and other diseases.

[Pereirine is one of the numerous substitutes for quinine, and is almost unknown in England and the United States. It is used largely in the West Indies, hypodermically and otherwise, as a febrifuge and antiperiodic. A short notice of its virtues may be found in a letter from Dr. Daunt, published in the "Medical Times and Gazette," vol. i., 1884, p. 443.—*Trans.*]

PHYSOSTIGMINA. PHYSOSTIGMATIS EXTRACTUM.

PHYSOSTIGMINE. ESERINA, ESERINE. EXTRACT OF CALABAR BEAN.

[Physostigma or Calabar bean contains an alkaloid known as physostigmine or eserine. In 1865 the term eserine was applied by Vée and Leven to an alkaloid differing from physostigmine. The existence of this has, however, not been confirmed beyond doubt. At the present time, the terms *eserine* and *physostigmine* are used synonymously both by medical writers and in commerce.—R.] Most of the salts of physostigmine are readily soluble in water. The solution of sulphate of physostigmine on exposure to air and light assumes a violet-red color, more or less intense, the change of tint being much less active in the case of the alkaloid itself than of its sulphate. The salicylate of physostigmine is soluble in 150 parts of water and in 12 parts of alcohol. The solutions of this salt are yellow, but become red under the influence of

light. Calabarine (Harnack and Witkowski), another alkaloid contained in Calabar bean, has a tetanic action, and is only rarely used medicinally.

As in the case of coniine (see CONIINA), the results of various investigators are very contradictory, and this is doubtless due to the varying composition of the preparations employed and also to the varying proportion of alkaloids contained in the Calabar bean. Nevertheless, the preparations of Calabar bean act alike on the eye, the salivary glands, the intestines, heart and respiration; their action on the spinal cord depends on the proportion of physostigmine, or of calabarine, respectively

Chief Physiological Effects of Physostigmine.— Pallor, then redness of the skin, abdominal pains, vomiting, embarrassed respiration, vertigo, feeling of extreme languor, myosis, salivation, sweats, slowing of the pulse (Fraser: toxic phenomena observed in himself). Watery and muco-sanguinolent diarrhœa, slowing and finally cessation of respirations. Complete paralysis and collapse (Evans). Death by asphyxia. Paralyzing effect on the central nervqus system; stimulating, then paralyzing effect, on the peripheral nerves. A dose of $\frac{1}{120}$ to $\frac{1}{60}$ of a grain is sufficient to induce poisonous symptoms in man (Harnack, according to whom there is no action on the peripheral nerves, but a direct action on the muscular fibre, voluntary and involuntary). In veterinary medicine, eserine has frequently been employed (Peters, Cadiot), especially in the treatment of colic in the horse. According to M. Cadiot, the dose of sulphate of physostigmine for the horse should be from 1¼ to nearly 3 grains. This author used a one-in-twenty solution. In the dog, the dose is from $\frac{1}{120}$ to $\frac{1}{4}$ of a grain. In canine chorea physostigmine seems to do more harm than good. In a case of epilepsy with idiocy, physostigmine, administered in doses of $\frac{1}{120}$ of a grain three days in succession, increased alarmingly the number of the fits. Elimination is effected by the saliva and bile.

The mutual antagonism between physostigmine and atropine is admitted by most authors, but is denied by Messrs. Fröhlich and Rossbach. Some authors have also asserted a reciprocal antagonism between physostigmine and strychnine.

Calabarine produces in the frog tetanic symptoms (Harnack); it has been used hypodermically by Dr. Bartholow.

Local Effects.—Sulphate of physostigmine produces very sharp pain which lasts from one to six hours. (Suarez y Cruz.)

Extract of Calabar bean, . . 2 grains
Distilled water, ... up to 80 minims.
Ten minims = ¼ of a grain.
(*Watson.*)

One injection every two hours. (The dose may be increased to ⅛ of a grain.)

Extract of Calabar bean, . . . 2 grains
Distilled water, . . . up to 112 minims.

(One to two syringefuls may be given = ⅛ to ¼ grain of extract. ("Pharmacopœia of Vienna Clinique.")

Extract of Calabar bean, . . . 1 grain
Glycerin, ... up to 64 minims.
(*Rosenthal.*)

This solution has been used by M. Silbermann (1880) in two cases of tetanus in young children (one case of cure).

Physostigmine, ... 1 grain
Alcohol, ... q. s.
Distilled water, . . . up to 128 minims.
Sixteen minims = ⅛ of a grain.
(*Erlenmeyer.*)

Physostigmine, ... 1 to 5 grains
Distilled water, ... to 112 minims.
Four minims = $\frac{1}{28}$ to ⅛ of a grain.
("Phar. of Vienna Clinique.")

Physostigmine and its sulphate may be injected in doses of from $\frac{1}{24}$ to $\frac{1}{18}$ of a grain [in both these cases, the sulphate, or better, the hydrobromate, should be used.—R.] (Bouchut), a dose which may be renewed 3 or 4 times daily, owing to the rapid elimination of the drug. These doses, and consequently the following, are perhaps too large; we find indeed in the memoir of M. Bouchut ("Recherches thér. sur l'action de l'éserine dans la chorée," 1875), that doses of from $\frac{1}{70}$ of a grain of eserine to $\frac{3}{70}$ of a grain of sulphate of eserine produce either a slight degree of paralysis of the diaphragm, or some embarrassment of the same muscle (pp. 10 and 11). Anger, in a case of tetanus, injected from ⅛ to ¼ of a grain daily; in another

case (Delamarre, "Thèse," Paris, 1876) ¼ of a grain were used in each injection till a dose of nearly 3 grains *per diem* was reached.

Salicylate, or hydrochlorate of physostigmine, ... 1 grain
Distilled water, . up to 1 ounce 80 minims.

Eight minims of this solution, that is to say, one-half of a Pravaz syringe containing 16 minims, are equivalent to $\frac{1}{10}$ of a grain of the physostigmine salt (Eulenburg, "Medicinal Kalender," 1883, Lewin).

[The following formula is from Martindale and Westcott's work:

INJECTIO PHYSOSTIGMATIS HYPODERMICA.

Extract of Calabar bean, . . 10 grains
Alcohol, ... 10 minims.
Rub together till smooth, and add
Acacia, in powder, ... 10 grains
Mix, and add gradually
Distilled water, ... to ½ fluid ounce.
Dose.—3 to 12 minims.—*Trans.*]

Therapeutic Uses.—Ptosis (Schelske), enuresis (Fronmüller, poisoning by strychnine (Newman), tetanus (Watson, 1866, Monti, Rothrock, Franzolini, Duffy, Suarez y Cruz, Th. Anger, Reulos), chorea (Harley, Ogle, Bouchut, Cadet de Gassicourt and Suarez y Cruz), trismus neonatorum (Eschenburg: from 1 to 5 drops of watery solution (¼ of a grain in 64 minims of water) of extract of Calabar bean.

In veterinary medicine the sulphate of physostigmine has been used for horses suffering from colic induced by surfeit and chronic dyspepsia (Dieckerhoff) in doses of from ½ to 1½ grains, in a solution of:

Sulphate of physostigmine, . . 1 grain
Distilled water, ... up to 112 minims.

Lindgvist recommends the same salt in doses of ¼ of a grain in the horse; to that of ¼ grain for 160 ounces body weight in the dog (maximum dose). It is especially useful in colic in the horse, dyspepsia and gastric atony in the ox. Möller rec-

ommends its use in doses of $\frac{3}{4}$ of a grain to $1\frac{1}{2}$ grain, in constipation due to a paretic condition of the intestines in the larger domestic animals.

Hydrobromate of physostigmine is soluble in water (especially warm water) and in alcohol, and slightly soluble in glycerin. It is perfectly neutral and produces no local irritation. Its solution is more stable than that of the other salts of eserine (Duquesnel). We do not know whether it has been used hypodermically.

PICROTOXINUM.

Picrotoxin.

Picrotoxin, obtained from the seeds of *Anamirta Cocculus*, is not an alkaloid. It is sparingly soluble (1 in 150) in water, and is freely soluble in boiling alcohol and in ether, also in alkalies, and in acids, but it forms no salts with the latter.

Picrotoxin in poisonous doses causes convulsions; it acts specially on the bulb, and, probably, on the whole extent of the spinal cord (Glover, Planat); its action on the cerebellum and corpora quadrigemina (Glover) is far from being proved.

Gubler has used picrotoxin hypodermically in labio-glosso-laryngeal paralysis; he obtained, after the lapse of some days, marked improvement. The dose was $\frac{1}{10}$ of a grain. Locally it produced persistent induration. Westbrook used it subcutaneously with benefit, for the night sweats of phthisis in doses of $\frac{1}{140}$ to $\frac{1}{48}$ of a grain. [Westbrook, "Archiv de Pharmacie," p. 867, 1884. See a *resumé* of this paper in the "Bristol Medico-Chirurgical Journal," vol. ii., p. 211. Drs. Westbrook and Platt used the drug in nine cases. It entirely checked the night sweats in six cases and afforded great relief in two. The drug was administered subcutaneously or by the mouth, at intervals of two to ten days, and in doses of from $\frac{1}{60}$ to $\frac{1}{20}$ of a grain. "It was found in some cases that $\frac{1}{20}$ of a grain hypodermically, at night, would control the sweats for ten nights following." Dr. Murrell also obtained good results but with much smaller doses,—he administered from the $\frac{1}{180}$ to $\frac{1}{60}$ of a grain, and had only one failure in twenty cases.—*Trans.*]

PILOCARPINÆ HYDROCHLORAS (ET NITRAS).
HYDROCHLORATE (AND NITRATE) OF PILOCARPINE.

Chief Physiological Effects.—Congestion of the skin, principally of the face; increase of the secretions, especially of saliva and sweat; acceleration of cardiac pulsations; initial increase of temperature (sometimes persistent, if diaphoresis fails) with consecutive fall in accordance with the greater or less abundance of perspiration.

In medicinal doses, the salts of pilocarpine never produce vomiting, diarrhœa, and that sense of extreme lassitude which frequently results from the administration of infusion of jaborandi. We may observe that in doses of less than $\frac{2}{3}$ of a grain the unpleasant effects resulting from the administration of the salts of pilocarpine have been for the most part observed in patients suffering from cardiac affections.

Local Effects.—Hypodermic injections of pilocarpine salts have never in our experience given rise to any accident whatever.

Nitrate or hydrochlorate of pilocarpine, ...	2 grains
Distilled water, . . .	up to 140 minims.

Dose—5 to 10 minims (= $\frac{1}{14}$ to $\frac{1}{7}$ of a grain) and upward.

It is well to begin with small doses, say $\frac{1}{14}$ of a grain, and to increase the dose cautiously to $\frac{1}{7}$, $\frac{2}{7}$, or $\frac{1}{3}$ of a grain. When the dose exceeds $\frac{1}{4}$ of a grain it is advisable to give it in divided doses, one half in the morning and the rest in the evening. We have never given a larger dose than $\frac{3}{4}$ of a grain, though some authors have administered as much as $1\frac{1}{2}$ grains, but this has been given by the mouth.

Therapeutics.—Pilocarpine is chiefly indicated in those cases where it is desirable to check or diminish excesssive salivary or sweat secretion. Injections of pilocarpine salts have been specially used in the treatment of various forms of dropsy, in pleurisy, bronchitis, pneumonia, acute articular rheumatism, epilepsy, eclampsia, mercurial poisoning, intermittent fever (Prokop, Rokitansky), unilateral sweats (André), fœtid perspiration of the feet (Armaingaud), rapidly progressive posterior sclerotico-choroiditis with muscæ volitantes and

threatened detachment of the retina (Dehenne, Deniau), detachment of the retina (Dianoux and others), some forms of polyuria (Roques, Huchard and Ducroux), syphilis (Lewin), diphtheria (Lehwess and Guttmann), anasarca in the horse (Signol). It has been given internally in combination with pepsin (Lereboullet, Lepidi-Chioti), in cholera (Maestre Perez). It seems difficult as yet to pronounce definitely as to the value of this therapeutic agent. There is an undoubted *antagonism* between the salts of pilocarpine and belladonna or atropine.

[Messrs. Martindale and Westcott give the following formula:

Nitrate of pilocarpine, . . .	1 grain
Distilled water, ...	20 minims.

Dose—2 to 6 minims.

Besides the diseases mentioned by the authors, pilocarpine has been used to assist uterine contractions, in uræmic coma, asthma, hydrophobia (mostly unsuccessfully), puerperal convulsions, and to relieve the pains of tabes dorsalis. An interesting case of cure of alopecia from pilocarpine injections is recorded in the "Lancet," vol. i., 1882. Brünauer has used it with success in a case of tetanus of rheumatic origin. M. Chéron has injected ¾ of a grain daily as a galactagogue, with complete success in eight out of nine cases. Dr. Purjeck has cured a case of atropine poisoning, and Dr. Roth a case of stramonium poisoning by hypodermic injections of pilocarpine.—*Trans.*]

PLATINUM.

(*See under Hydrargyrum.*)

POTASSII BROMIDUM

Bromide of Potassium.

M. Bergeron has used it hypodermically in a case of mania; its use was followed by sloughs. M. Alling, in a case of puerperal eclampsia, met with suppuration after each injection (7¾ grains in 40 minims of water). M. Asshurot has met with ulceration after the hypodermic injection of bromide of potassium. Dr. Weir Mitchell, on the other hand, has never observed local ill effects after these injections, which only occur, according to Pepper, in cases of idiosyncrasy.

Messrs. Martin-Damourette and Pelvet, who have also administered potassium bromide hypodermically, assert that in *small doses* it produces marked hypnotic effects. They have also stated that its injection caused: (1) Pain. (2) Muscular tremor, affecting in the first instance the muscles adjoining the injected point, and gradually extending, after two or three minutes, to the most distant muscles. (3) Enfeeblement, first of movement and afterward of sensibility. This condition is manifest after 5 or 10 minutes in the limb in which the injection has been made and becomes general after 20 to 40 minutes. Sensibility disappears in the following order:—skin, motor nerves, spinal cord, muscles (those which have been affected by absorption), for the muscles of the injected region lose their sensibility in a few minutes, by imbibition, before they are affected by encephalic poisoning. Respiratory movements cease soon after voluntary movement. (4) Diminution of capillary circulation, and, finally, arrest of the heart. Martin-Damourette and Pelvet say that death is at the last due to paralysis of the respiratory muscles, contrary to the opinion of Eulenburg and Guttmann, who attribute death to cardiac palsy. (5) Lowering of the temperature and increase of the secretions. (6) In man, enfeeblement of the generative functions.

Messrs. Martin-Damourette and Pelvet think it safer not to exceed at one dose 32 grains in one injection, lest local disturbances might ensue. They are further of opinion that even when several punctures are made, the dose should not exceed one drachm.

M. Luigi Frigerio, and afterward M. Carmelo Andromico, have used hypodermically a solution of the following composition:

Bromide of potassium, . . .	½ grain
Distilled water, ...	up to 16 minims.

The former has given as much as 8 grains in each injection, but this dose has caused ill effects locally; he has seen abscess and sloughing even from a dose of 3½ to 4 grains. He selects the skin of the forearm for injection, and observes that by gently manipulating the part injected it is possible to avoid the risk of suppuration. It is well also to enjoin rest of the limb, and M. Frigerio often sends his patients to bed. By

this treatment the frequency of epileptic convulsions is diminished. Local accidents, though frequent, are inconsiderable.

POTASSII CYANIDUM.

(*See Acidum Hydrocyanicum.*)

POTASSII IODIDUM.

Iodide of Potassium.

M. Eulenburg has used an aqueous solution (1 in 3) of potassium iodide, of which he injected 16 minims at one time. In many cases of scrofulous glandular enlargements, and more frequently in glandular affections due to syphilis, which were treated by this method, he failed to obtain any good result. In syphilitic periostitis the treatment was not much, if any, more efficacious, and syphilitic cutaneous ulcers did not appear to heal more rapidly than when treated in the ordinary way by internal administration. He did not meet with more success in several experiments which he made in patients affected with rheumatic or scrofulous affections of the joints, even when the disease was treated from the beginning.

The therapeutic results reported by Dr. Thierfelder differ from those of Prof. Eulenburg. This author obtained certain and definite results from this use of the drug, which were rapid and decided in cases of osteoid pains. The same authority has, besides, made use of iodide of potassium in various other diseases; thus, in a case of chronic rheumatism of the cervical vertebræ, after two injections (1 grain in each), he obtained free movement of the head; in a case of hysteria and in a case of gastric ulcer with gastralgia, injections of potassium iodide produced effects analogous to those resulting from morphine injections. In short, Dr. Thierfelder believes that these injections are specially indicated in cases where the digestive functions require to be treated.

Locally, the same author observed after hypodermic administration of iodide of potassium, burning pain of varying intensity and duration; in some cases he noticed tearing pain radiating into the surrounding parts, and in two cases he met with circumscribed phlegmons.

Messrs. Fronmüller, Jakubowitz, and Mader also used hypodermic injections of iodide of potassium. Goldbaum injected

iodides of potassium and sodium in the asphyxial stage of cholera, with the object of studying the absorption of medicines.

The rapid absorption of iodide of potassium, according to Eulenburg, does not encourage us to expect local effects of any importance from its use. Concentrated solutions frequently produce local irritation and even suppuration. (These observations are, for the most part, borrowed from Eulenburg.) M. Gilles, of la Tourette, has used the following hypodermic injection of potassium iodide.

Iodide of potassium, ...	8 grains
Distilled water, ...	16 minims.

This solution produces no local accidents "provided that the solution is neutral, that the injection is made as deeply as possible in some part where there is abundance of cellular tissue, and that the punctures are at a sufficient distance from one another." They produce an unpleasant sense of smarting which speedily abates.

M. Besnier has also used iodide of potassium hypodermically, but he has not published his observations. M. A. Denis states in his essay that he has injected 8 grains of iodide of potassium without any ill effect beyond sharp pain at the moment of injection. M. L. Julien, in his "Traité des maladies vénériennes" (1879, p. 1060), says, "In conclusion, the hypodermic injection of iodide of potassium has been highly recommended (A. Martin)." Unfortunately, M. Julien does not give any of the bibliography on this subject, and our own researches are, so far, without result. There is no reference to hypodermic injections of iodide of potassium in Messrs. Belhomme and Martin's "Traité de la syphilis," edition of 1876.

Iodide of potassium, . . .	24 grains
Distilled water, . . .	up to 112 minims.

Although this solution is inconvenient on account of the pain which it sometimes causes, Prof. Carbo has obtained good results from its use.

M. Cantarano ("Il Movimento," January, 1883) has used iodide of potassium hypodermically, in the latter stages of syphilis, where, from any cause, the internal administration of the salt was contra-indicated. He did not meet with any local

troubles, as he took the precaution to select for injection parts which were richly supplied with connective tissue and by adding to the solution a small proportion of morphine; the fluid should be neutralized by the addition of a few drops of acetic acid and eight minims only should be injected at one time.

M. Parona ("Gazetta degli ospitali," 1884, Nos. 52, 53, 54, 55) condemns solutions of 8 grains in 16 minims for hypodermic use. The solution of this strength is nearly half-saturated and local accidents from its use are frequent. He has generally used solutions of 1½ to 3 grains in 16 minims of distilled water, gently warmed in a sand bath. According to this author cold injections are always productive of pain, more or less severe according to the strength of the solution, circumscribed phlegmons resulting from doses of 6 to 9 grains; tepid injections produce a less pronounced local reaction, especially after the application, for one or two hours, of an ice bladder. The combination of morphine with the iodide he deemed immaterial, the pain being only momentary. He frequently observed local disturbance from the injections recommended by Cantarano (8 grains in 16 minims).

In conclusion, the author thinks unfavorably of hypodermic injections of iodide of potassium; he points out the small quantity of salt which is introduced at a time into the system, the inconvenient results to which these injections may give rise, and, finally, he accords the preference to rectal injections. These contradictory statements tend to show that the iodides of potassium used have not been identical. Iodides vary greatly, the iodide of commerce being very impure. In a note published in the 68th number of the "Gazetta degli ospitali," M. Parona says that he had actually used the commercial iodide, but that the French iodide of potassium in a solution of 8 grains in 16 minims was neither very painful nor irritating.

[We have left this remark unchanged. But it is based on misconception or want of knowledge of the subject. There is no "commercial" iodide of potassium on the market, as distinguished from any "medicinal." It is true that sometimes a batch of iodide of potassium is found which contains slight impurities, but these are usually very small in quantity, and there is no justification for saying that "the iodide of commerce is very impure."—R.]

[Dr. Carl Schadeck has recently instituted a series of clinical experiments with the iodides of sodium and potassium in the treatment of syphilis, by the hypodermic method. The patients were soldiers in the Kiew military hospital. Eight cases were treated, ninety injections in all being made, and the largest number of injections made in one case was sixteen; in the others the number of injections was twelve, ten, nine, eight, and seven. The iodide of potassium was the salt mostly used, only eleven injections in all having been made with the iodide of sodium.

Iodide of potassium (sodium), .	40 grains
Distilled water, ...	150 minims.

The solution was prepared fresh day by day, and was carefully neutralized and filtered. A Pravaz syringe was used to make the injections and the needle was in twenty-six instances inserted perpendicularly, so as to carry the solution directly into the parenchyma of the gluteal muscles.

Dr. Schadeck's experience[40] is summarized as follows:— 1. Pain was either trifling or absent at the time of injection. 2. There was invariably secondary painful irritation, which varied in intensity and duration in different instances. 3. No abscess or inflammatory induration resulted at the point of injection. 4. In two cases, after nine or ten injections, an iodine exanthem in the form of acne pustules appeared on the face, trunk, and extremities. The eruption vanished when the injections were discontinued. 5. In two instances all syphilitic lesions were eliminated by the exclusive use of the salts of iodine hypodermically. 6. The results, so far as obtained, tend to show that mercury is not an essential in the treatment of syphilis.—*Trans.*]

POTASSII PERMANGANAS.

Permanganate of Potassium.

Hypodermic injections of potassium permanganate have been recommended by M. Lacerda in the treatment of the bites of venomous serpents. Dr. Brown also recommends these injections in diphtheria, in which disease he believes that the remedy acts as a specific.

Permanganate of potassium, . .	1 grain
Distilled water, . . .	up to 112 minims.

Dose—32 to 48 minims after ligature of the limb above the wound.

QUINIDINA ET CINCHONIDINA.

QUINIDINE AND CINCHONIDINE.

Quinidine, which is isomeric with quinine, possesses very nearly the same physiological properties. It was used first by Wunderlich in 1860. The *sulphate of quinidine,* sparingly soluble in water, but rendered soluble upon addition of an acid, was administered in typhoid fever by Strümpel, who regards it a superior to sulphate of quinine. Quinidine and its salts are not in use for hypodermic purposes.

Cinchonidine is isomeric with cinchonine. According to Bouchardat, it might be used as a substitute for quinine; Coronado and Gubler regard it as equal to quinine in therapeutic value. The *hydrobromate,* used hypodermically by the last-named authors, was found to be perfectly innocuous; it produced no signs of cinchonism or any local disturbance in doses of 6 to 8 grains. M. Chiron asserts that it is capable of producing epileptiform convulsions by irritation of the cortical motor centres, which, beginning in the muscles of the face, spread thence to those of the neck, arm, etc.

Bouchardat and Wedel say that sulphate of cinchonidine is as efficacious as sulphate of quinine. It has been prescribed with success in cases of intermittent fever, in doses of from 12 to 16 grains, without producing vertigo, tinnitus, visual troubles, weight of head, or obfuscation of the ideas. Its action is less toxic than that of quinine, but its effects are less marked and of shorter duration.

Sulphate of cinchonidine, . .	40 grains
Acetate of morphine, . . .	½ grain
Distilled water, . . .	up to 1 ounce.

12 minims = 1 grain of cinchonidine and $\frac{1}{60}$ of a grain of morphine. M. Machiavelli injected about 16 minims of this solution, substituting in this formula the hydrochlorate for the sulphate of cinchonidine.

Cinchonine, cinchonidine, and their salts are moderate in

price. Possibly some of the cinchonidine salts, especially the hydrobromate, might with advantage be substituted for quinine salts in hypodermic medication. [At the present time (July, 1889) the price of quinine sulphate has become so low—being about 25 cents per ounce, wholesale—that considerations of economy need not any longer control the choice between quinine and other cinchona alkaloids.—R.]

QUININA.

Quinine and its Salts.

Quinine is very sparingly soluble in water (1 in about 1600); it dissolves in ether [and in alcohol, chloroform, and dilute acids.—*Trans.*]

Principal Physiological Effects.—Antiputrescent and antifermentative (Binz); sialagogue, by reflex stimulation, in virtue of its bitterness; diminishes tactile sensibility, and dulls the sense of hearing, causes tinnitus aurium, and hallucinations of hearing; vertigo, sense of weight of head, confusion of ideas, carotid pulsations, cephalalgia, quinine intoxication, ataxic gait, apathy, drowsiness, general prostration; dilatation of the pupils, and nausea.

In Larger Doses.—Vomiting, delirium, deafness, occasionally blindness, and aphasia.

In Poisonous Doses.—Collapse, convulsions, and death.

There are increased volume of the red corpuscles, due to increased supply of oxygen, disappearance of amœboid movements of the white corpuscles, the number of which is diminished; the area of splenic dulness is diminished.

In moderate doses, up to 15 grains [this is a decidedly large dose, and the symptoms which are described do not follow from moderate doses.—*Trans.*], there are first increase and then slowing of the cardiac pulsations, and lowered blood pressure; finally, there is arrest of respiration, followed by paralysis of the heart.

In healthy men and animals the effect on the temperature is either nil or trifling. With the exception of the various fevers dependent on malarial poison, in which quinine acts as a powerful antipyretic, its action on the temperature is still *sub judice*.

Elimination is effected rapidly and chiefly by the kidneys,

the secretion of urine becoming very abundant, while the secretion of sweat is arrested. In some rare instances various eruptions (eczematous and scarlatiniform) and hæmaturia have been observed after the administration of quinine. Some cases of tetanus have been ascribed to injections of quinine (?).

Local Effects.—As a general rule, great circumspection is necessary in using hypodermic injections of quinine and its salts; for, in many instances, it produces, besides pain, persistent indurations, followed by suppuration and even by gangrenous sloughs and tetanic symptoms, especially with the sulphate. It is advisable to inject no more than 16 minims at one point and to expel the fluid very gently. The hydrochlorate appears to be the most suitable of all the salts of quinine for hypodermic injection. In cases of urgency, such as pernicious fevers, we ought not to be deterred from using hypodermic injections by the risk of local accidents. For this reason we deem it right to mention some solutions, although they are often faulty, which have been proposed by various writers, for they possess at least an historic interest.

M. Galvani recommends that 8 to 12 grains of bisulphate or hydrochlorate of quinine should be dissolved in 3 minims of distilled water in a capsule or glass tube, by the aid of a water-bath. The salts of quinine should be dissolved by heat alone without the aid of acids, and thus prepared they are not apt to produce local troubles. This author's practice is, however, open to question, when we find that he recommends the use, for three days, of cold water compresses at the point of puncture, which are to be renewed every ten minutes.

Pure quinine is not suitable for hypodermic use on account of its sparing solubility. Otto used a solution of it in ether and in this way he was able to administer it in a concentrated form without local ill effects.

Quinine, ...	8 grains
Ether, ...	20 minims.

[In the experience of some of the largest hospitals of New York City, the *Bimuriate of Quinine and Urea,* which is soluble in 1 part of water, is the most suitable and least liable to produce pain or abscesses.—R.]

Prof. Eulenburg found that this solution produced considerable local irritation, and he recommends its abandonment.

M. Kuhn, of Strasbourg, had previously recommended an ethereal solution, and Dr. Bartholow also employed it, but on the other hand, M. Ventzel Bernatzik always found its use followed by local accidents. M. Burdel used the following solution with benefit in several severe cases of pernicious fever:

Sulphate of quinine, . . .	16 grains
Ether, ...	up to 64 minims.

Dose.—16 minims = 4 grains.

The injection was repeated daily and no ill results followed.

[There must be an error in the above formula, as *sulphate* of quinine is almost insoluble in ether. But *hydrate* of quinine, that is, the freshly precipitated alkaloid, is soluble in this menstruum.—R.]

The basic, or so-called neutral, sulphate, on account of its sparing solubility in water and alcohol, can only be used with great difficulty in a sufficient degree of concentration; it is moreover necessary, in order to increase the degree of solubility, to acidify the solution with sulphuric, hydrochloric (Bernatzik), nitric (Desvignes), citric (Hunter), tartaric (Bourdon), or acetic acid. These concentrated solutions produce, in consequence of their acidity, local irritations which may result in ulceration or suppuration. These accidents may be avoided by the use of very dilute solutions, but they, in their turn, possess the inconvenience of necessitating numerous injections; moreover such solutions do not keep well. Glycerin is the best vehicle; of this it requires 6 parts by weight, for solution, with the aid of heat; of cold glycerin, however, it requires 40 parts. M. Denis, who has employed a solution of the sulphate in glycerin, has discontinued this form of solution, as he could only obtain weak solutions ($\frac{1}{4}$ grain to 8 minims) even with the aid of heat.

Moore used the following solution:

Sulphate of quinine, . .	24 grains
Diluted sulphuric acid . . .	10 minims
Distilled water, . . .	up to 240 minims.

10 minims = 1 grain.

[In order to avoid too great acidity of the solution, an error which may readily occur by using a *prescribed* quantity of acid, it is preferable to add diluted acid very cautiously to the quinine salt, which should have been previously rubbed up

with the larger portion of the water to a perfectly smooth milk, until the liquid is *nearly*, or just clear. Then filter.]

This solution being difficult to use, it was soon set aside for the acidulated preparation of M. Craith:

Sulphate of quinine, ...	2 grains
Diluted sulphuric acid, . . .	q. s.
Distilled water, ...	up to 16 minims.

Later on, Prof. Eulenburg suggested the following formula:

Sulphate of quinine, ...	2 grains
Diluted sulphuric acid, . . .	q. s.
Distilled water, ...	up to 20 minims.

These latter formulæ were of uncertain composition owing to the varying proportions of acid necessary to effect solution. Therefore, Claude Bernard, seeing the numerous accidents which ensued from their use, attributed these ill effects to the sulphuric acid, for which he proposed to substitute tartaric acid.

Bourdon, Gualla, and Vinson adopted the following formula:

Sulpnate of quinine, . . .	3 grains
Tartaric acid, ...	1½ grains
Distilled water, ...	up to 32 minims.

16 minims = 1½ grains.

Pilhan-Dufeillay and Decaisne prepared an extemporaneous solution by dissolving the quantity of salt required for injection in a sufficiency of Eau de Rabel [the equivalent of the French Pharmacopœia for our acidum sulphuricum aromaticum, though the latter is considerably weaker], a proceeding not only inexact, but as often as not impracticable, and by which they introduced another irritant, viz., alcohol, into the formula.

The formula of Pilhan-Dufeillay is:

Sulphate of quinine, ...	3 grains
Eau de Rabel, ...	7 minims
Distilled water, ...	up to 16 minims.

We have used it at the Bicêtre without any more serious trouble than pain and induration, but we only used 3 minims

of Eau de Rabel, which we found sufficient to effect solution of the quinine salt. We may here remark that if the greater number of quinine solutions proposed by various authors are to be rejected on account of the accidents to which they may give rise, it is not less true that, in cases where they must be used, it is possible to avoid, to a great extent, the inconveniences which might otherwise result by care in the operative procedure; this explains why, in the hands of some physicians, even very irritating solutions do not give rise to local troubles.

M. A. Denis, from whom we borrow these remarks, after considering all the methods which had been tried to attain the desired end, says that after using tartaric acid in the first place, he set it aside for sulphuric acid, as he found that the latter caused much less pain. The solution which was used in the first instance was prepared in the following manner by Mr. Hepp. The quinine sulphate was first triturated with the tartaric acid in a mortar, a little water was then added, and the whole heated in a water bath; the remainder of the water was then added, allowance being made for evaporation, and after filtration a limpid fluid was obtained, containing—

Sulphate of quinine, ...	3 grains
Tartaric acid, ...	1 grain
Distilled water	20 minims.

This solution, although it was superior to all the preceding, nevertheless threw down a deposit after some time; he therefore tried the following prescription:

Sulphate of quinine, . . .	24 grains
Diluted sulphuric acid, . . .	15 minims
Distilled water, . . .	up to 168 minims.

7 minims = 1 grain.

M. Hepp tried to reduce the acidity of this preparation, which made it too irritating, and prepared a fresh solution in such a way that the sulphuric acid would be adjusted so as to just form the bisulphate or acid sulphate of quinine.

Sulphate of quinine, . . .	24 grains
Diluted sulphuric acid, . . .	12 minims
Distilled water, . . .	up to 168 minims.

1 grain in 7 minims.

This solution reddened litmus paper, and preserved its limpidity without any precipitate for several months. He in-

jected ½ of a grain of the sulphate and he believed that it would have been easy to obtain a greater degree of concentration by warming the solution before injection. This plan, which Mr. Denis thought it desirable to avoid, was successfully carried out by Dr. Goldschmidt, of Grafenstaden, for whom M. Hepp prepared the following solution:

Sulphate of quinine,	12 grains
Tartaric acid,	4 grains
Distilled water,	up to 24 minims.

This solution threw down a large deposit in the cold, but soon became clear again after immersion for a short time in boiling water. Dr. Lente, of New York, used the subjoined formula:

Sulphate of quinine,	15½ grains
Diluted sulphuric acid,	18 minims
Carbolic acid,	1 grain
Water,	up to 112 minims.

16 minims = ½ grain.

Out of 300 injections there were only two instances of abscess and one of slough. One is naturally astonished at these results with a fluid containing such a large proportion of acid, and much more than enough to produce solution.

Many of these preparations are open to criticism. Many authors employ the term *sulphate of quinine* without specifying to which of the two sulphates they refer, and hence arises a most regretable confusion. [In the case of American or English authors it is safe to say that only the officinal, "basic" sulphate of quinine is meant, when they speak of it. —R.] This uncertainty characterizes the solution of M. Ravicini (of which he administers six syringefuls per diem in typhoid fever) the sulphate of quinine (basic or neutral) being insoluble:

Sulphate of quinine,	25 grains
Morphine hydrochlorate,	½ grain
Distilled water,	up to 250 minims.

Desvigne's formula is:

Sulphate of quinine,	4 grains
Nitric acid (dilute ?),	2 minims
Distilled water,	up to 48 minims.

1 grain in 12 minims.

One of the authors has injected the following solution, which has also been used by other authors, in a severe case of typhoid fever:

Sulphate of quinine, ...	1½ grains
Acetic acid, ...	q. s.
Distilled water, ...	up to 16 minims.

This solution gave rise to considerable local irritation and abscess, probably due to the adynamic condition of the patient.

The next two formulæ are taken from Bernatzik:

Sulphate of quinine, . . .	12 grains
Diluted hydrochloric acid, . .	8 minims
Distilled water, . . .	up to 24 minims.

2 minims = 1 grain.

Sulphate of quinine, ...	10 grains
Hydrochlorate of morphine, . .	1 grain
Diluted hydrochloric acid, . .	6 minims
Distilled water, . . .	up to 50 minims.

5 minims contain 1 grain of the quinine and $\frac{1}{10}$ of a grain of the morphine salt. [This formula and that of Ravicini would be much improved by the substitution of hydrochlorate for sulphate of quinine.—*Trans.*

Sulphate of quinine, ...	8 grains
Diluted sulphuric acid, . . .	1½ minims
Distilled water, ...	up to 64 minims.

12 to 24 minims = 1½ to 3 grains.

This preparation, which is recommended by Dr. Bartholow, should be carefully filtered to remove undissolved particles of the salt and foreign bodies. [In the last edition of his work, Dr. Bartholow gives, as the best sulphate preparation, the following formula:

℞ Quininæ disulphatis, ...	gr. 50
Acidi sulphur. dil., ...	♏ 100
Aquæ, ...	fl. oz. 1
Acidi carbolici liquefacti, . . .	♏ 5.

Solve. *Trans.*]

The *bisulphate of quinine*, really the neutral sulphate [not as to reaction, but in a chemical sense], though commonly styled the acid sulphate, is much more soluble than the sul-

phate, and is consequently more suitable for hypodermic purposes. It dissolves with vivid blue fluorescence in 10 parts, while the sulphate requires 740 parts, of water at 59° F. It is freely soluble in alcohol, and it dissolves in three parts of warm glycerin, forming a solution which will keep good an indefinite time.

Eulenburg makes use of the following solution:

Bisulphate of quinine, . . . 6 grains
Glycerin, ... up to 64 minims.
Sixteen minims = 1½ grains.

One or two syringefuls are generally sufficient. This prescription may be modified by mixing equal parts of water and glycerin.

Vée, and afterwards Gubler ("Commentaires du Codex"), suggested the following solution:

Acid sulphate of quinine, . . . 1 grain
Distilled water, ... up to 12 minims.

Rosenthal's solution:

Acid sulphate of quinine, . . . 2 grains
Distilled water, ... up to 12 minims,

is apt to deposit crystals of quinine sulphate in the cold.

The *basic hydrobromate* ("neutral") and the *"acid" hydrobromate* of quinine have been used hypodermically by Gubler, Soulez, and by Raymond. The former salt, which is richer than the sulphate in alkaloid [this is not correct; the percentage in alkaloid quinine, calculated as anhydrous, in the more common quinine salts (crystallized) is as follows: acetate, 84.3; bisulphate, 59.1; hydrobromate, 73.5; hydrochlorate, 81.7; quinine and urea hydrochlorate (bimuriate), 69.0; lactate, 78.2; salicylate, 68.8; sulphate, 74.3; valerianate, 72.9.—R.], is soluble, according to Eulenburg, in four parts, and according to Boiile, in ten parts of glycerin. It dissolves in 16 parts of cold water, and in 3 parts of alcohol at 59° F.

The *acid hydrobromate* is very soluble; according to Gubler its action appears to differ from that of quinine sulphate by its being less apt to produce symptoms of cinchonism, and by its marked sedative and hypnotic influence on the nervous system. Injections of quinine hydrobromate cause considerable pain.

Gubler's solution (1 part in 10).

Neutral hydrobromate of quinine, .	1½ grains
Alcohol, ...	4 minims
Distilled water, ...	up to 16 minims.

[This is the hydrobromate officinal in the U. S. Pharmacopœia.—R.]

Dardenne's solution for use in intermittent fevers:

Acid hydrobromate of quinine, .	3 grains
Diluted sulphuric acid, . . .	1 minim
Or, tartaric acid, ...	1½ grains
Distilled water, ...	up to 32 minims.

Auliffe, of St. Denis, Réunion, recommends the following prescription:

Hydrobromate of quinine, . .	8 grains
Ether, ...	80 minims
Alcohol, ...	20 minims.

Rosenthal gives the preference to a solution in glycerin, as being of a non-irritating character. M. Chéron recommends injections of quinine hydrobromate (1 in 20 to 1 in 10) in the treatment of the morphine habit. M. Maximowitsch, of St. Petersburg, has given the *acid hydrobromate* in doses of from 2¼ to 3½ grains in several acute diseases.

Acid hydrobromate of quinine,	18 to 30 grains
Distilled water, . . .	up to 112 minims.

Warm and filter. The solution should be freshly prepared. With the rare exception of induration, this injection did not cause any local irritation.

The *basic sulpho-vinate of quinine* dissolves in 2 parts of water, forming, according to Dziewonski and Jaillard, a clear solution which keeps well.

Sulpho-vinate of quinine, . .	2½ granis
Distilled water, . . .	up to 16 minims.

Of 45 observations which he has collected, M. Dziewonski reports 4 cases of abscess, 2 in which sloughs formed, and a few in which injection was followed by induration. The basic sulpho-vinate of quinine has been used in intermittent fever by Messrs. Bourgeois, Pugens, Moret, Merz and Dardenne. M. C.

Paul administered acid sulpho-vinate of quinine in one case of intermittent fever.

The *carbolate of quinine* [this is not a true chemical salt. —R.], originally recommended by Bernatzik, has been used lately by M. Maestre Perez in the treatment of cholera:

Carbolate of quinine, . . .	5 grains
Alcohol, ...	up to 16 minims.

Three injections are given one after the other, in the first stage of cholera.

The *formate of quinine* is fairly soluble; it has been used by Messrs. Namias, Lévi and Calza. The *quinate, tannate, valerianate*, and *lactate* of quinine have been tried, but we do not think them of sufficient importance to do more than mention them here. The *citrate of iron and quinine* has been used hypodermically by M. Rosenthal; it is extremely soluble in water. According to Prof. Eulenburg, Berg, of Dresden, recommends a green citrate of iron and quinine [the color, in this case being caused by the presence of ammonium citrate].

The *hydrochlorate of quinine and urea* [in continental phraseology often called *chininum hydrochloricum* or *muriaticum carbamidatum*], which is soluble in its own weight of water, has been injected in a 50-per-cent solution by M. Jaffé, 16 minims being equivalent to 5½ grains of the quinine salt. The local reaction is as a general rule trifling, neither redness nor puffiness being observable. In doses of 16 grains, hummings of the ears are frequently observed, but only in women.

Otto Saltzmann, of Breslau, used this salt in 10-per-cent solution—one syringeful at a dose. Its use was never followed by suppuration, and better results were obtained than by the internal administration of quinine.

In intermittent fevers its action has always been uniform, and the paroxysms have been arrested after 3 or 4 injections. In typhus the temperature falls considerably after the injection of two or three syringefuls.

The *hydrochlorate of quinine*, suggested by M. Binz, is richer in quinine than the sulphate, besides being more soluble, easier of absorption, and less liable to decomposition. It has been used hypodermically by Messrs. Bernatzik, Steinhaus, Galignani, and others, sometimes in watery solution, at others dissolved in glycerin or in ether (Winckel).

Hydrochlorate of quinine,	3 grains
Gycerin,	8 minims
Water,	up to 16 minims.

(*Kohn.*)

Four syringefuls, or 12 grains, at the commencement of a maniacal paroxysm, were administered without either local or general accidents, by taking the precaution to warm the solution and to give it in divided doses.

Hydrochlorate of quinine,	10 grains
Diluted hydrochloric acid,	8 minims
Distilled water,	up to 20 minims.

(*Bernatzik.*)

In the "Real-Encyclopædie," Bernatzik gives the formula thus:

Hydrochlorate of quinine,	10 grains
Diluted hydrochloric acid,	4 minims
Distilled water,	up to 20 minims.

Steinhaus' formula:

Hydrochlorate of quinine,	4 grains
Diluted hydrochloric acid,	q. s.
Distilled water,	up to 24 minims.

This solution produced ulceration and sloughing of the cellular tissue. Prof. Ziemssen gives the following prescription:

Hydrochlorate of quinine,	8 grains
Diluted hydrochloric acid,	2 minims
Distilled water,	up to 20 minims.

Therapeutic Uses.—Quinine has been used subcutaneously extensively and by many physicians in the treatment of intermittent fevers, in tubercular, intermittent, and in remittent fevers. In septicæmia, mania, neuralgia, cholera, and infantile cholera, typhoid fever, acute and chronic articular rheumatism, sunstroke, convulsions, hydrophobia and pyæmia.

In conclusion, injections of quinine salts should only be practised in cases of urgency, or when there is difficulty in administering it per os or per rectum.

[Dr. Smirnoff[41] reports the results obtained by the hypodermic use of quinine in the treatment of 470 malarial soldiers. The average number of injections required in each case was

2.5, the greatest number in an individual case being nine. Relapse was rarer after treatment by subcutaneous injection than after the internal administration of quinine. The hydrochlorate was the salt used, and it never gave rise to serious local troubles, such as abscess or sloughing, while the pain caused by injection was trifling. Dr. Aitken, of Rome, recommends a solution of the bisulphate, one grain of which dissolves readily in six minims of equal parts of pure glycerin and distilled water. To this solution, two per cent of pure carbolic acid must be added. Thirty minims of this solution (= 5 grains of bisulphate of quinine) may be injected at one time in severe malarial affections, and also in the treatment of hyperpyrexia. (See, for further remarks on the use of quinine hypodermically, the article on *Sodii Salicylas.*)—*Trans.*]

QUINOIDINA. CHINOIDINUM.

QUINOIDINE. CHINOIDIN.

This is a mixture of various cinchona alkaloids, partly such as exist naturally in the bark, but mostly of secondary amorphous bases produced from the former during the process of manufacture of the crystallizable alkaloids. [Since the manufacturing process has been changed by the abandonment of strong acids and alkalies and protracted heat, very little quinoidine is obtained as a by-product by the quinine manufacturers at the present time. Indeed, it is their object to prevent its formation entirely, as it is only produced at the expense of the more valuable alkaloids.—R.]

Quinoidine is easily soluble in acidulated water. Bernatzik has used amorphous quinine (quinoidine) in ethereal solution.

Prof. Eulenburg thinks, after investigations which he has made, that both the ethereal solution and the tincture of quinoidine should be set aside.

Quinoidine, ...	10 grains
Ether, ...	up to 32 or 44 minims.

Reduce by evaporation to 20 minims. This solution frequently produces abscess.

The *hydrochlorate of quinoidine* is soluble in an equal part of water and is readily absorbed. Mosler used it in hypertrophy of the spleen.

QUINOLINA.

Quinoline. Tartrate and Hydrochlorate of Quinoline.

[Quinoline is an artificially produced base or alkaloid, intimately related to quinine, cinchonine and other natural alkaloids. It is a liquid, forming with acids crystallizable salts.—R.] It is insoluble in water, soluble in alcohol, ether, chloroform, and benzol. The *tartrate* and *salicylate* are stable salts; the former is readily soluble in water, the latter dissolves in 80 parts of water, and in alcohol, ether, benzol, vaselin, glycerin, and fixed oils.

Chief Physiological Effects.—Marked fall of temperature (Donath, von Jaksch, Biach, and Loimann), diminution and irregularity of respiratory movements, gastric disorder (nausea and vomiting), noises in the ears, sensation of pressure on the nucha.

In poisonous doses: frequent respirations, diminution and finally loss of reflex excitability, total paralysis, and death (frequently with hyperæmia and œdema of the lungs). Quinoline and its salts possess antiseptic properties; it has been used as a substitute for quinine, but is not so employed now; it is, moreover, much more expensive than quinine. ["The tartrate of quinoline is soluble in water and has the taste of peppermint. [Tartrate of quinoline requires 80 parts of water for solution. Its taste rather resembles that of oil of bitter almonds, than that of peppermint.—R.] It lowers the temperature, prevents coagulation of the blood, and possesses remarkable antiseptic properties. Given by the mouth it acts like quinine, but without causing noises in the ears or giddiness." Dr. Donath; quoted in "London Medical Record," vol. xii., p. 161.—*Trans.*]

M. Hagens[42] used hypodermic injections of citrate of quinoline, without serious local disturbance, in 34 cases of intermittent fever.

Citrate of quinoline, ...	30 grains
Citric acid, ...	6 grains
Distilled water, . . .	up to 45 or 60 minims.

In 25 per cent of the cases the paroxysms ceased: in the others, there was one return in 55 per cent. The results from

internal administration were, immediate cure in 71 per cent, and one relapse in 28 per cent of the cases.

Local Effects.—The *tartrate, hydrochlorate,* and *citrate* of quinoline are the only salts used for hypodermic injections. Injections of the hydrochlorate, according to Von Jaksch, who has used it in doses of 3 grains, are painful and often followed by extensive infiltration of the cellular tissue. The tartrate is preferable for this purpose. The medium dose hypodermically for an adult is from 3 to 16 grains.

Therapeutic Uses.—The salts of quinoline have hitherto been used with varying and uncertain results in intermittent fever, neuralgia, typhoid fever, whooping cough, tuberculosis, pneumonia, erysipelas, and septicæmia.

Further researches into the action of these salts are required before pronouncing on their therapeutic value.

[Further information on quinoline, or chinoline salts, may be found in the "Lancet," vol. i., 1882, p. 324, and an excellent *resumé* of their nature and properties will be found in an article entitled "Recent Studies in Therapeutics. XII. Resorcine and its Allies," in the "British Medical Journal," vol. ii., 1881, p. 945. I have frequently used tartrate of chinoline, by internal administration, as an antipyretic in pneumonia and erysipelas. Its effects on the pulse, as tested by sphygmographic tracings, and on the temperature, closely resemble those which follow on the administration of kairine.—*Trans.*]

RESORCINUM.

Resorcin.

Resorcin is a derivative of benzol, is isomeric with hydroquinon and pyrocatechin, dissolves to almost any extent in water, and is also soluble in ether, alcohol, glycerin, and vaselin. It is insoluble in chloroform and carbon disulphide. Aqueous solutions when exposed to air and light soon acquire a brownish color, without appreciable alteration, according to the degree of concentration; their reaction is neutral.

Principal Physiological Effects.—Resorcin possesses the same properties as carbolic and salicylic acids; a one-per-cent solution prevents fermentation, and a one-and-a-half-per-cent solution prevents putrescence. Its poisonous properties are less than those of carbolic acid. Resorcin has been frequently

used of late in those numerous affections for which carbolic acid is prescribed. The dose for adults has generally been from 40 grains to ʒ ij. It is always desirable to commence with small doses.

Hippocrate Callias [43] says: "In doses of from 4 to 8 grains to every kilogramme of the animal's body weight, it produced tremor, clonic convulsions, and acceleration of pulse and respiration, all these symptoms disappearing in the course of an hour. Sensibility and consciousness were unaffected. Beginning with 8 grains for every kilogramme, severe vertigo and loss of consciousness supervened, sensibility was dulled, the convulsions became violent and frequent and were mostly localized to the anterior portion of the animal's body. The pupils were dilated, respiration and circulation were very much accelerated, but the temperature was not much affected. There was a return to the normal condition at the end of two hours.

"In doses of from 14 to 16 grains per kilogramme, death supervened in half an hour, preceded by the same symptoms, the limbs, however, being less affected, and there were tetanic spasms of the nuchal muscles. The temperature invariably rises gradually till, at the moment of death, it reaches 106° F."

According to M. Russo Giliberti, resorcin in medium doses of one grain per kilogramme produced in three quarters of an hour lowering of the temperature to the extent of nine-tenths of a degree C., a return to the original temperature taking place in two hours. In a dose of 2¾ grains there is a fall of 1.6° C., but this is a poisonous dose. Elimination of carbonic acid is only slightly influenced by this drug.

Resorcin brought into contact with albuminous substances or with egg albumen, causes immediate coagulation, forming an albuminate of resorcin. Slightly concentrated solutions are possessed of caustic properties, causing opacity, with white discoloration of the cellular and muscular tissues. In man, resorcin often produces noises in the ears and vertigo. Elimination is rapidly effected by the kidneys. For use either by deep or subcutaneous injections, the following formula may be used:

Resorcin, ...	5 to 20 grains
Distilled water, . . .	up to 112 minims.

16 minims = ⅔ to 3 grains.

These injections give rise to no local troubles.

In inveterate sciatica, intramuscular injections of resorcin, in a ten to twenty per cent solution, often produce a healthy local derivation. A five-per-cent solution has been used hypodermically, with success, by Messrs. Bogusch, Stibnewski, and Ugo Bassi. This strength of solution has also been used by Cattani without local or general ill results. He asserts that he has obtained by this method definite and rapid effects.

[Dr. Murrell found that a dose of ʒ ij. of resorcin administered in one dose to a young woman who was suffering from asthma, produced alarmingly toxic phenomena. "She was, in a few minutes, in a profuse perspiration from head to foot; there was complete loss of voluntary power and reflex action, the pulse at the radials was weak and thready, and the temperature in the axilla was only 94° F. Restoratives were applied, consciousness was soon restored, and the temperature gradually returned to the normal" ("Medical Times and Gazette," 1881, vol. ii., p. 486). Dr. Andrew first used hot baths as restoratives, but latterly he has had recourse to red wines, especially the good vintages of Bordeaux and Burgundy, and he has found that under the influence of these stimulants the toxic symptoms speedily vanish. Dr. Dujardin-Beaumetz, who was the first in France to use resorcin, has entirely discontinued its internal administration. In his work, "Les nouvelles médications," Paris, 1886, he says that he was led to abandon the use of resorcin in rheumatism and typhoid, not only on account of its powerlessness, but also on account of the toxic phenomena to which it gave rise. After quoting the experiments which he made in conjunction with Hippocrate Callias, referred to above, he says:—"While recognizing the fact that resorcin is not so poisonous as carbolic acid, I came to the conclusion that it was a dangerous remedy as an antipyretic, for I observed in patients suffering from typhoid fever who were treated by resorcin, the same depression of the vital powers, the same adynamia, and the same pulmonary congestion which I had previously seen in patients who had been treated by carbolic acid. I have therefore discontinued the use of this drug, and I believe that in Germany also, resorcin is seldom administered internally; nevertheless, for external application, in the treatment of unhealthy wounds, it is an invaluable remedy." In addition to the diseases mentioned by

the authors for which resorcin has been administered, it has been used in whooping cough by Dr. Moncorvo,[44] in the treatment of diarrhœa, by internal administration in combination with castor oil, and "in paroyxsmal colic accompanying cancerous, dysenteric, tuberculous, and other diseases of the intestinal tract, and insomnia. In every instance where resorcin is administered as a hypnotic it must be given in toxic doses."

See also for further information as to its therapeutic uses, "Neale's Digest," 1882, and Appendix, 1886.—*Trans.*]

SANGUIS.

BLOOD. (*See Injectiones Nutrientes Hypodermicæ.*)

SAPONINUM.

SAPONIN.

Saponin, which is a glucoside, is a proximate principle existing in many plants, for instance in the root of *Polygala Senega*, and is but little soluble in cold water. Prof. Eulenburg was induced by the researches of Messrs. Pelikan and Kohler to use it hypodermically, but without success. It was employed in two and five per cent solutions in sciatica, neuralgia, and in several cases of epilepsy with aura.

Saponin, ... 1 grain
Distilled water, ... up to 50 minims.
Five minims = $\frac{1}{10}$ of a grain.

Saponin, ... 1½ grains
Distilled water, . . . up to 30 minims.
Five minims = $\frac{1}{4}$ of a grain.

Prof. Eulenburg says that the local ill effects (sharp pain, obstinate induration, and erysipelatous redness), and the general symptoms (rigors, nausea, vomiting, paresis, and headache) contra-indicate its use for therapeutic purposes.

SCILLAINUM and SCILLIPICRINUM.

SCILLAIN (OR SCILLITOXIN) and SCILLIPICRIN.

According to Jarmested, scillain (a glucoside extracted from squill) has the same action as digitalin when injected hypodermically. Scillipicrin, another glucoside extracted from

squill, has been injected subcutaneously by Dr. Fronmüller as a diuretic.

Scillipicrin, ... 1 grain
Distilled water, . . up to 12 or 60 minims.

Dose.—⅓ to ½ grain of the active principle.

SERUM.

(*See Injectiones Nutrientes Hypodermicæ.,*

SODII CHLORIDUM.

Chloride of Sodium.

The hypodermic injection of saline solutions causes sharp pains and is followed by induration, sometimes even by abscess.

Bertin and Gray state that when preceded by an injection of atropine sulphate, the solution of salt does not cause pain.

Injections of salt solutions are mostly used in the treatment of neuralgia, sciatica, lumbago, angina pectoris, torticollis, and muscular spasms. M. Lubanski, of Nice, has administered them in the diarrhœa of phthisis to aid appetite and digestion; he never saw local accidents result. A 1 in 20 solution of chloride of sodium has been used for hypodermic transfusions (see sections on Nutrient Injections, and Sodium Sulphate).

SODII IODIDUM.

Iodide of Sodium.

M. Arcari has used this salt hypodermically. The dose required by this method is one third of that required in administration by the mouth, and it does not produce any local trouble (see Potassii Iodidum).

SODII LACTAS.

Lactate of Sodium.

Lactate of sodium, which was proposed by M. Preyer for use as a hypnotic, in doses ranging to upward of four drachms, has been used subcutaneously in doses of nine grains. No hypnotism was induced, and the point of injection was the

seat of intense pain. The experiments made by M. Bötticher in the clinique of Prof. Nothnagel, show that this salt is at best but a feeble and uncertain hypnotic.

SODII SALICYLAS.

Salicylate of Sodium.

Salicylate of sodium is freely soluble in water.

Principal Physiological Effects.—Buchholtz, Binz, Domingos, and Freire assert that salicylate of sodium arrests fermentation and prevents putrescence, but Kolbe and others deny this action. It causes slowing both of the circulation and of respiration, and lowers the temperature and blood pressure. *In large doses* it causes copious perspiration, nausea, vomiting, and tinnitus aurium. *In poisonous doses* it causes convulsions and asphyxia from paralysis of the respiratory centre. *Elimination* is effected by the kidneys.

It must not be forgotten that salicylate of sodium is contra-indicated in alcoholism, cerebral lesions, cardiac adynamia and renal diseases.

Local Effects.—According to Messrs. Domingos and Freire, with the exception of ecchymosis, local troubles are very rare if the drug is sufficiently diluted. Hence, when it is desirable to inject a large dose, this must be done by means of several punctures. M. Collard, of Liége, who has used salicylate of sodium hypodermically in typhoid fever, had to discontinue its use owing to the local injury to which it gave rise. These authors have recommended hypodermic injections of salicylate of sodium in yellow fever in doses of 16 and 24 grains and upward in the first, and of 1½, 2, and 3 grains, in the second stage.

Salicylate of sodium, . . .	4 grains
Distilled water, ...	up to 16 minims.

Salicylate of sodium should be absolutely neutral, and the solution should be made, and filtered, only when required. The solution which has been used by Dr. Dujardin-Beaumetz and others produces neither pain nor local ill effects. Caffeine is associated in it with the sodium salicylate.

Caffeine, ...	16 grains
Salicylate of sodium, . . .	12 grains
Distilled water, . . .	up to 32 minims.

[In connection with the subject of hypodermic injections of quinine, salicylic acid, and salicylate of sodium as antithermic agents, it may not be very much out of place to supplement the observations in "The Manual" by some remarks on this subject by recent authors. In the first place it should be observed that in cases of pyrexia, not dependent on malarious influences, quinine is, as a general rule, not available by hypodermic injection, for this reason that, as Dr. Lauder Brunton points out, large doses (from five to twenty grains) are required to produce an antipyretic effect, and that it is more effectual in this way when given in one, or at the most, two doses per diem. The difficulty of doing this without producing serious local inconvenience at the point of injection is self-apparent.

Dr. Dujardin-Beaumetz[46] says that, except in the case of malarial affections, the salts of quinine are inferior in antithermic power to other drugs, and that to obtain appreciable effects in pyrexia it is necessary to administer them in gramme (15 grain) doses, which, he adds, are fraught with danger to the heart and brain, as well as to other organs. There is, however, one condition of pyrexia in which Professor Jaccoud has obtained most encouraging results, that, namely, which characterizes the period of excavation in ordinary phthisis ("fièvre d'ulceration ou d'excavation"). The plan adopted by this author is to administer the first day, at intervals of ten minutes, four capsules containing each seven and a half grains of hydrobromate of quinine; the patient takes in this way ʒ ss. in half an hour. If the temperature compared with that of the previous evening does not fall a degree, he administers twenty-two grains, in the same way, on the second evening; then on the third day, even if the evening temperature does not exceed that of the morning, two doses of seven or eight grains each are given, with an interval of ten minutes between them. After this there is an interval of two days, after which, if necessary, the same method is resumed. If, for any reason, this plan is inadmissible, Prof. Jaccoud substitutes for it the following: 15 grains of quinine hydrobromate are dissolved in 80 minims of distilled water; 16 minims of this solution, or a Pravaz syringeful (= 3 grains of the quinine salt), are injected. This dose is equivalent to 7½ grains per os. Hence two injections = 15 grains, four injections = 30 grains,

and so on. Proceeding according to this method, three injections are made the first day, two the second, and one the third; then comes an interval of two days, after which the same routine is followed. "These injections," Prof. Jaccoud adds, "are not more painful than morphine injections; they give rise to no serious trouble, provided only that they are made into the subcutaneous cellular tissue, and not merely into the deep layer of the derma; sloughing, abscess, erysipelas, or glandular enlargement never results, as I can assert after a large experience; an erythematous redness develops round the point of puncture, which rarely extends beyond the size of a five-franc piece, and which disappears in two or three days; but it must be remembered that a hard indolent nodosity remains, which adheres to the deep surface of the skin, and that this induration, which entails no further inconvenience, persists for at least from six weeks to two months." (See also some remarks by Prof. Nothnagel on the use of quinine as an antipyretic, and especially on its abuse, in the "Medical Times and Gazette," 1884, vol. ii., p. 797.) In the fever due to re-absorption of the products of softening and excavations in phthisis, Prof. Jaccoud recommends salicylic acid or salicylate of sodium. If the stomach is tolerant of the former drug, it is administered in its natural condition in capsules containing eight grains; if neither salicylic acid nor salicylate of sodium is well borne by the stomach, the latter drug is administered hypodermically, six grains of the salt being injected into each arm. In this way a fall of temperature was obtained equal to that obtained by one drachm of salicylic acid, but the antipyretic affect was generally delayed to the day succeeding the injection.—*Trans.*]

SODII SULPHAS.

Sulphate of Sodium.

Gubler was the first to use this salt hypodermically, but without producing purgation; it was subsequently used by Luton (1½ grains in 16 minims of water) with slight laxative effects.

Sulphate of sodium, . . . 10½ grains
Distilled water, . . . up to 112 minims.
16 minims = 1½ grains.

The use of sulphate of sodium hypodermically has been recommended by M. Luton in the different forms of vomiting and in cholera. He uses a syringe with a capacity of 5 grammes (80 minims). The injections should be made deeply and in regions well supplied with subcutaneous cellular tissue. He uses a 1 in 10 solution.

Hiller ("Ueber die subcutane Anwendung von Abführmitteln."—"Zeitsch. f. klin. Med.," Berlin, 1882, pp. 481, 497) has experimented with a large number of purgatives by the hypodermic method, among which may be mentioned aloin and colocynthin, which produced serous stools, in from 4 to 6 hours, and intense local pain (a 1-in-10 solution was used), citrullin, the extract of colocynth, elaterin, the cathartic acid of senna, leptandrin, euonymin, baptisin, etc. This writer, as a result of his experiments, concludes that there is no advantage to be gained by the administration of purgatives hypodermically, and that this method should only be adopted in those cases in which internal administration is impossible.

In some cases, especially in athrepsia, M. Luton recommends either sulphate of sodium or the following solution:

Sulphate of sodium, ...	10½ grains
Phosphate of sodium, . . .	5 grains
Distilled water, . . .	up to 112 minims.

Minimum dose, 80 minims administered once a week.

SOLANINE.

[Although the existence of this alkaloid has been known since 1821, its therapeutic properties have only recently been studied, and it is to Dr. Geneuil that we are chiefly indebted for a knowledge of its actions. It is obtained from potato shoots and also from the parings of very young or very old potatoes. Solanine belongs to the same class of poisons as atropine, physostigmine, and pilocarpine, its first physiological effect being to paralyze the nerve-terminals of non-striated muscular fibre. The alkaloid solanine is crystallizable, insoluble in water, slightly soluble in ether, and readily so in hot alcohol. It forms salts with acids. The hydrochlorate of solanine, which is a gelatinous body, readily soluble in water, may be given in doses ranging from one to three or four grains daily. In some cases Dr. Geneuil does not hesitate to

give as much as eight grains daily. He regards it as a narcotic to the medulla, spinal cord, and nerve-trunks, and as a paralysant to the terminal ends of sensory and motor nerves. It does not produce cerebral congestion, but in poisonous doses it is said to affect the cerebral cortex, causing headache, delirium, cyanosis, and somnolence.

The drug is best administered hypodermically, as it is apt, when administered by the mouth, to cause nausea, vomiting, and a desire to defecate.

Solanine does not produce the unpleasant after-effects which are apt to follow the administration of morphine and atropine, and it has no cumulative action.

Therapeutics.—Solanine may be prescribed to combat excitement, spasm, and pain. It has produced excellent results in the treatment of sciatica and rheumatic neuralgia, and it has proved of service in the treatment of gastritis, acute dyspepsia, the vomiting of pregnancy, bronchitis, bronchial asthma, cardiac asthma, and emphysema. It has been used in cystitis, prurigo, and in some nervous affections in which restlessness and insomnia were prominent symptoms.

It may safely be prescribed for young children and old persons.[47]—*Trans.*]

SPARTEINE.

Sparteine is an oily, fluid alkaloid, extracted from *Cytisus Scoparius* (Leguminosæ — Papilionaceæ), the shoots of which contain besides another principle, scoparin. These two principles have been extracted by M. Merck (see "Chemiker-Zeitung," iii., 1879, p. 380). Scoparin, a yellow powder, in which crystalline needles can be distinguished by the aid of the microscope, is sparingly soluble in water and readily so in alcohol and glycerin. It has feebly acid properties. It has been administered hypodermically in ½-grain doses as a diuretic.

Scoparin, ...	6 grains
Glycerin, ...	30 minims
Distilled water, ...	up to 96 minims.

Eight minims = ½ a grain.

The salts of sparteine are crystallizable. The decoction of the shoots, of a brownish or orange-red color, possesses purga-

tive, diuretic, and slightly narcotic properties. The physiological properties of sparteine closely resemble, according to Messrs. Nothnagel and Rossbach, those of coniine. (See also an essay by Rymon, Paris, 1880.)

Sulphate of sparteine, . . .	2 grains
Distilled water, ...	112 minims.

(*Fronmüller sen.*)

The diuretic effects appear after doses of ¼ of a grain (16 minims of solution).

STRYCHNINA.

Strychnine and its Salts.

Strychnine is obtained from *Nux vomica* and *St. Ignatius bean.* The bark of the *Strychnos Tieuté* and of the hoang-nan also contains strychnine. It is very sparingly soluble in water, alcohol, and ether. Its salts are all soluble in water and are more rapidly poisonous than the pure alkaloid. The hydrochlorate and the nitrate are more active than the sulphate, as the latter contains much water of crystallization.

Chief Physiological Actions.—Increase of tactile sensibility, tinglings, salivation, anxiety, vertigo, rapid breathing, stiffness of the nuchal muscles, tetanic spasms in rapid succession, merging into one another, with opisthótonos and forcible extension of the lower limbs and of the trunk, trismus (from the action of the poison on the bulb and spinal marrow), dilatation of the pupils, elevation of blood pressure, abolition of energy of the motor nerves, slowing of cardiac pulsations, death by asphyxia, arrest of the heart, and unascertained modifications of the nerve centres. Strychnine is also possessed of decided antiputrescent and antifermentative properties. The cumulative action of strychnine is generally admitted; Leube and Rosenthal assert that habituation can be acquired by prolonged use.

Local Effects.—Sulphate of strychnine does not cause any local trouble, and the same thing is true of the nitrate. Erection of the hair-follicles (goose-skin) has been observed at the point of puncture.

Dose.—According to Husemann, the minimum lethal dose is ½ of a grain. It should at first be administered in very mi-

nute doses—from $\frac{1}{140}$ to $\frac{1}{10}$ of a grain, cautiously increased until the appearance of certain toxic phenomena (stiffness of muscles of neck, spasms, etc.), when the administration must be suspended.

Antagonisms.—Calabar bean (Watson and Keyworth), chloroform inhalations (?), and chloral (Liebreich, Rajewsky). A pseudo-antagonism exists between strychnine and curarine.

[Urethane is alleged by Prof. Anrep to be nearly as efficient and much less dangerous an antagonist than chloral. Dr. Bignon (of Lima) concludes, from experiments made upon dogs, that cocaine is a physiological antagonist to strychnine. Up to a certain point after the ingestion of poisonous doses of strychnine, the animal could always be saved by hypodermic injections of cocaine, but when too large doses of strychnine were administered, it always perished from the correspondingly large doses of cocaine required.[48]—*Trans.*]

Nitrate of strychnine, . . . $\frac{1}{2}$ grain
Distilled water, . . . up to 112 minims.
Eight minims = $\frac{1}{28}$ of a grain.

Sulphate of strychnine, . . . 1 grain
Distilled water, . . . up to 288 minims.
Sixteen minims = $\frac{1}{18}$ of a grain.
Four minims = $\frac{1}{72}$ of a grain.
(*Bartholow.*)

Sulphate of strychnine, . . . 3 grains
Distilled water, . . . up to 336 minims.

Eight minims (= $\frac{1}{14}$ of a grain) to be injected, *in divided doses*, round the anus, every two days, in the rectal prolapse of children. (*Dolbeau.*)

Nux vomica and strychnine have been recommended by Luton and others in the treatment of delirium tremens:

Sulphate of strychnine, . . . 1 grain
Cherry-laurel water, . . . 112 minims
Distilled water, . . . up to 224 minims.

Sixteen minims = $\frac{1}{14}$ of a grain. An injection every half-hour till four have been given, after that every hour. (Luton says the dose should reach $\frac{3}{4}$ to $\frac{1}{4}$ of a grain of strychnine sulphate.)

Tincture of nux vomica has been used hypodermically by M. Luton in threatened asphyxia from catarrh, in the death agony, and in the last stage of conditions of adynamia in doses of as much as 80 minims. As to the local effects, this writer has observed slight swelling, heat, and a moderate degree of pain, all of these symptoms disappearing in an hour or two.

Therapeutic Uses.—Paralysis of the vocal cords, of the crico-thyroid muscles (Waldenburg, Neudorfer), saturnine palsy (Lorent), rectal prolapse in children (Wood, Foucher, Dolbeau, Büdder, Lorent, Gualla, Heusch). Guersant and Giraldès never obtained any benefit from its use.

In various forms of paralysis, such as hemiplegia, paraplegia, paralysis from compression of the radial nerve, Bell's paralysis (in Bell's paralysis M. Courty injected hypodermically, with success, from 6 to 12 minims of a 1 or 2 per cent solution every second or third day), hemeralopia, amaurosis, writer's cramp, urinary incontinence, the lightning pains of tabes, sciatica, pulmonary emphysema, cholera, chloral poisoning, diphtheritic paralysis, infantile paralysis, progressive muscular atrophy, and locomotor ataxy

Maestro Perez has recommended injections of 4 to 5 minims of a 2-per-cent solution in the second stage of cholera.

[I have thought it desirable in this, as well as in a few other places, to omit a long list of names of writers who have used the remedy in the various diseases named, chiefly because the authorities quoted are not readily accessible to English readers.

Atropine has been used to antagonize the poisonous effects of strychnine. In the "British Medical Journal" (vol. i., 1880, p. 671) two cases of strychnine poisoning successfully treated by atropine by Dr. Roberts are quoted from the "Philadelphia Medical Times." In one of these cases the strychnine had been administered in whiskey, and Dr. Roberts found that after the exhibition of ten minims of this solution in a cat, the poisonous symptoms, which were produced within five minutes, were overcome by giving atropine in powder by the mouth.

Gubler ("Commentaires du Codex," 2d edit., p. 761) says that *possibly* atropine is antagonistic to strychnine, but Bartholow ("Hypodermatic Medication," 4th edit., p. 258) strongly combats this view and asserts that atropine intensifies the

effects of strychnine, and hastens death "by contributing to the tetanic fixation of the muscles of respiration." This opinion is confirmed by McReddie ("British Medical Journal," vol. i., 1883, p. 973) who, after experimenting on dogs, found that atropine, as well as chloroform, amyl nitrite, and eserine, neither prevented the fatal result nor arrested the convulsions. McReddie's results as regards the antagonism between strychnine and amyl nitrite are probably fallacious; they are contradicted by the experimental researches of the late St. Clair Gray, of Glasgow ("Glasgow Medical Journal," 1871, p. 188), and by the clinical experience of Dr. Barnes ("British Medical Journal," 1882, vol. i., p. 458) in a case of accidental poisoning by strychnine. Dr. H. A. Hare, of Boston (quoted in "London Medical Record," vol. xiii., p. 75) finds that nitrite of amyl does prolong life in strychnine poisoning, but that its action is so fleeting that it can be only used to tide over the patient until other more persistent remedies can be administered. He recommends an injection in the first instance, the effect being then kept up by means of inhalations.

Physostigma has been used as an antidote. Dr. White, of Glasgow, used it successfully in a case of strychnine poisoning, but chloroform inhalations were used simultaneously ("Glasgow Medical Journal," 1871, p. 488). Dr. Byrne, of Russelville, Ky., records a case of recovery after a dose of ten grains of strychnine had been taken, three doses of 4 minims each of extract of calabar bean having been administered, but in this case also it is impossible to say how far the physostigma contributed to the successful result, as ipecacuanha, chloral, and chloroform had also been administered ("Lancet," vol. ii., 1882, p. 1105). Dr. Fothergill has shown that strychnine is an antidote to aconitine.

Strychnine administered hypodermically has been found of the greatest value in cases of cardiac failure. The experiments of Lauder Brunton and Cash show that this drug stimulates the motor ganglia of the heart, and the former authority states that "the action of strychnine on the motor centre in the heart is probably similar to its action on the vasomotor and respiratory centres."

Dr. Herbert Habershon points out that in this respect strychnine differs from alcohol, ether, ammonia, and digitalis, which are to a large extent muscle stimulants. Hence in

some cases strychnine will succeed when other stimulants have failed. He recommends the hypodermic use of strychnine in the following classes of cases:

"(1) In many cases where the feebleness of the heart's action depends primarily upon an acute lung affection, such for instance, as in some cases of acute pneumonia, or a case of renal disease in which a sudden œdema of the lung supervenes, accompanied by rapid and feeble action of the heart. In these the double action of strychnine on heart and lungs alike renders it of especial value. (2) In cases of cardiac disease where, by the primary affection of the heart, the arterial system is unfilled, the great nerve centres in the brain suffer from a want of nutrition, and are, so to speak, starved. (3) In a third class of cases the feeble action is due to a reflex cause (also in the course of cardiac disease); for instance, 'shock' produced by exhaustion, by a local cause, such as embolus in the brain, by extreme cold, or emotional excitement or fright."

Strychnine hypodermically has been recommended and used in threatened failure of respiration occurring in opium poisoning, but I have been unable to find the reference.—*Trans.*]

STRYCHNINÆ ARSENIAS.

Arseniate of Strychnine.

[A new remedy introduced and clinically tested by Russel, for which it is claimed that it posesses the properties both of arsenic and strychnine in combination. The preparation is readily soluble in glycerin and water, and as it is easy of absorption and produces no local disturbance when given subcutaneously, it is well adapted for that purpose.

Arseniate of strychnine, . . .	1 grain
Glycerin,	
Distilled water equal parts,	up to 256 minims.

Dose.—Should begin with 4 minims, gradually increased to 8 and then to 16 minims = $\frac{1}{64}$, $\frac{1}{32}$ and $\frac{1}{16}$ grain respectively).

Therapeutics.—Arseniate of strychnine possesses powerful antiseptic properties, in virtue of which it is of the highest value in the early stages (prodromata) of acute infectious dis-

eases. When administered in the initial stage of infectious fevers, it overcomes the symptoms of general malaise, muscular lassitude, etc., and the patient experiences relief even after a single injection. Dr. Russel has found the drug of special use in the treatment of typhoid fever, which disease, he asserts, it aborts in the early stages, or simplifies, when administered after the fever is fully developed; and he attributes these effects to the power which the remedy possesses of "sterilizing, as it were, the soil on which the pathogenetic micro-organisms of typhoid fever vegetate."[49]—*Trans.*]

TAYUYA.

Tayuya.

Tayuya, which is obtained from the root of the *Dermophylla pendulina* (Cucurbitaceæ), has been introduced into medical practice by M. Ubicini, of Pavia. The Italian physicians use it as a bitter tonic and ascribe to it anti-syphilitic and anti-scrofulous properties. In scrofula and syphilis they appear to have obtained almost magical results from the use of this drug. Messrs. Ambrosoli, of Milan, and Gamberini, of Bologna, used tincture of tayuya hypodermically. The former injected it pure in doses of sixteen minims in 3 cases of constitutional syphilis, and observed only a very trifling local reaction. In 2 cases, 1 injection (!!) sufficed to effect a cure; in the third case the injection was repeated in 8 days, after which recovery was complete (!).

Professor Gamberini began with injections of the tincture diluted with half its bulk of water, and then used injections of undiluted tincture; a dose of 16 minims was well borne, but it gave rise to a hard indolent swelling. Many other Italian physicians, following these observers, have used tayuya and frequently with the same success, especially in scrofula. Dr. Eulenburg, who has experimented with the tincture of tayuya of M. Ubicini has not found any real benefit result from its use in full doses; Messrs. Geber, who used it internally and subcutaneously with comparative success, slight syphilitic eruptions yielding under its influence, Concetti, Pelizarri, Maracci, Zanarelli, Rasoir and Zeissl obtained similar negative results, while Prof. Sigmund, of Vienna, found that tayuya was not only inefficacious but positively injurious.

THALLINA.

THALLINE.

Thalline is a derivative of quinoline. The name of thalline has been given to this substance on account of the green color which it produces on contact with perchloride of iron. It was discovered by Skraup and was first used by Jaksch, of Vienna. All the salts of thalline, the tartrate, sulphate, hydrochlorate and acetate, dissolve readily in water, but the solution gradually becomes dark. For this reason, solutions of thalline salts should be made freshly when wanted. The sulphate, which is generally used for therapeutic purposes, dissolves in 7 times its weight, and the tartrate in 10 times its weight of cold water. Solutions of thalline have a bitter, saline taste, and a peculiar aromatic flavor.

Jaksch was the first to discover the antipyretic properties of thalline. He used the hydrochlorate, sulphate, and acetate of thalline, in doses of 3½, 7 and 10½ grains. The fall of temperature was considerable, amounting to several degrees, but he frequently observed sweats coincidently with the fall of temperature, succeeded by rigors and an ultimate rise of temperature. Collapse never occurred. There have also been observed increase of blood-pressure (Pisenti), and a fall in the pulse and respiration. The minimum of temperature was reached in from 2 to 3 hours after exhibition of the drug, which, further than this, exercised no influence on the progress and duration of the various diseases for which it was prescribed.

The effects produced by thalline last longer than those obtained from kairine; it is more active than antipyrine (3½ grains of the former = 16 grains of the latter), but the effects of antipyrine last longer. In doses of 8 to 12 grains the salts of thalline did not produce any toxic phenomena in rabbits, and doses of 7 grains did not produce any symptoms in a healthy man. All the salts of thalline arrest fermentation. According to Jaksch, elimination is effected by the kidneys. Messrs. Brouardel and P. Loye have demonstrated that thalline has the same *modus operandi* as kairine, that it acts, namely, by destruction of the hæmoglobin.

Dr. Alexander has experimented in the clinic of Dr. Biermer

with the sulphate and tartrate of thalline, and has obtained results identical with those of Jaksch. With a dose of 4 grains the effect lasted, on an average, only two hours, hence it was necessary in order to obtain a constant effect to repeat the dose of the drug every two hours. M. Grocco, of Pavia, has used *acetate of thalline,* which he found was a powerful antipyretic in doses of 4 grains. The symptoms observed after its use were profuse sweats, and diminution in the frequency of the pulse and respirations. In some cases where there was intolerance of the drug, he administered it without inconvenience by the hypodermic method in doses of 1½ grains. The average duration of the action of this salt varied between four and six hours.

M. Mingazzini has used the *sulphate* and *tartrate* of thalline. He has moreover used the following solution hypodermically.

Sulphate of thalline, ...	3 grains
Distilled water, ...	up to 16 minims.

As there is a precipitate from this solution in the cold, it is necessary always to use it warm. This solution did not cause abscess or other local accidents. In a dose of 1½ grains, which is equivalent to 4 grains administered per os, the lowering of the temperature reached 2.1° to 2.3° C. and persisted for a period of six to nine hours.

M. Pisenti also states that solutions of sulphate of thalline in water used hypodermically are perfectly safe.

Thalline has this advantage over antipyrine, that the dose required is much smaller, and that it but rarely induces vomiting. Antipyrine, on the other hand, produces effects which last longer, as a rule does not cause rigors, lowers the pulse rate as well as the temperature, and finally, according to certain writers, it exerts a favorable influence on the joints in acute articular rheumatism.

[For further information on the value of thalline as an antipyretic, see papers in the "Practitioner," vol. xxxv., p. 222, and vol. xxxvi., p. 256; "London Medical Record," vol. xiii., p. 455; "British Medical Journal," 1886, vol. i., pp. 83 and 608.

Professor Ehrlich and Dr. Laquer treated sixteen cases of typhoid fever with doses of thalline, ranging from ½ to 1¼ grains every half-hour or hour. In all the cases the temperature was

reduced to the normal standard in from four to five days, on an average. The dose which suits an individual case having been ascertained, it may be administered at frequent intervals without risk. These authors regard thalline as a specific in typhoid fever. Jannsen found this drug much inferior in therapeutic value to quinine in malarial fever, but of great service in phthisis, as very small doses sufficed to control the fever. Dr. Ewald ("Medical Record," loc. cit.) says of thalline, kairine, and antipyrine—"they are by no means antipyretic remedies in the sense that they possess the power of reducing the temperature itself, *i.e.*, the increased oxidation which causes the rising of the temperature, and manifests itself by the measurable temperature of the surface of the body; they are merely antithermic remedies. Their action may be compared with the effect of opening the windows of an overheated room. The temperature will sink near the window but will increase in proportion as we approach the fireplace, where the heat will remain unaltered. The same is the action of these remedies; they induce an increased radiation of heat to the surrounding media, probably by dilatation of the blood-vessels, but they have no influence whatever on increased oxidation and on the pathological process itself. The blood nearer to the focus of the inflammation will receive heat, and give it off again on the surface of the body. This explains why, on discontinuing the remedy, such immediate and rapid rising of the temperature will take place, which is not the case with the genuine febrifuge medicines, such as quinine, the action of which is more permanent."

Professor Jaccoud reports most favorably of the value of thalline as an antipyretic. In the "Gazette des Hôpitaux," he gives the results obtained from its use in the treatment of typhoid fever, the fever of tuberculosis, pneumonia, and erysipelas. He considers thalline to be the most valuable antipyretic agent we possess, and he states that by its systematic use, in small doses, it is possible to maintain a permanent condition of apyrexia in febrile cases. (A short extract from this paper may be found in the "Bristol Medico-Chirurgical Journal," vol. iii.)—*Trans.*]

THEBAINA.

THEBAINE.

Thebaine has been used hypodermically in the treatment of neuralgia by Prof. Eulenburg, who found that it caused severe smarting pain at the point of puncture, and by M. Waldemar, of St. Petersburg.

TRANSFUSIO HYPODERMICA.

HYPODERMIC TRANSFUSION.

(*See Nutrient Injections, Sulphate and Chloride of Sodium.*)

URETHANUM.

URETHANE.

[Urethane occurs in the form of white crystals, is free from odor, has no disagreeable taste, and is freely soluble in water. It is the ethylic ether of carbamic acid, and its chemical composition is represented by the formula $C_3H_7NO_2$.

Von Jaksch, of Vienna, considers that this drug is peculiarly suited for administration to children. It is most useful in simple uncomplicated insomnia, but it is apt to prove ineffectual when there is acute pain.

Although as much as 30 to 60 grains may safely be given to adults, Dr. Saundby has obtained good results from the exhibition of two-grain doses in cases of cardiac insomnia. Mr. Jackman used urethane, in 4-grain doses every 2 hours, with success in a case of tetanus, after chloral, given in 20-grain doses every 3 hours, had failed to do more than relieve the pain. Dr. Sprimon, of Moscow, verified the statements of Jaksch by experiments on himself, patients, and animals (rabbits and cats). He found that hypodermic injections were painless, even when 16 grains were introduced (in an experiment on himself).

Dr. Savage administers it in cases of insanity in doses of five grains hypodermically, or one to two drachms by the mouth.—*Trans.*]

VALDIVINE.

This principle has been obtained by M. Tanret from the seeds of the *Simaba Valdivia* (Simarubaceæ), a tree indige-

nous in Columbia. [This principle is so little used that it is not even to be found on the lists of Merck and other manufacturers of alkaloids.—R.] It is very sparingly soluble in water (1 in 600 parts), is soluble in alcohol (1 in 60 parts), less so in absolute alcohol (1 in 190 parts), dissolves readily in chloroform, but is insoluble in ether.

Valdivine has very pronounced poisonous properties; it produces death in rabbits in doses of $\frac{1}{3\frac{1}{4}}$ to $\frac{1}{17}$ of a grain according to the size of the animal, but it must be observed that its effects are very slow in developing. During the first four or five hours the animal appears to be as well as before administration; there are often observed, however, especially after very large doses, a rise of temperature and an increase in the number of the heart beats. M. Restrepo, from whom we derive all our information, has noticed vomiting as well, in the dog and man, after a dose of $\frac{1}{17}$ of a grain. The physiological researches of this author are still incomplete, and valdivine requires further investigations.

The dose administered to man has never exceeded $\frac{1}{17}$ of a grain. Locally we find that sometimes "there is slight puffiness at the points of puncture."

Valdivine, ... 1 grain
Distilled water, . up to 1 ounce 80 minims.
16 minims = $\frac{1}{35}$ of a grain.

Drs. Restrepo and Dujardin-Beaumetz have administered it unsuccessfully in intermittent fevers, and experiments made with it at the *Jardin des plantes* in the bites of venomous serpents (Crotalus adamanteus and durissus) have also been without result.

M. Nocard has experimented with valdivine in rabbits which had contracted dumb rabies. It appears that no further result was obtained than a sedative action in the most severe cases.

VASELIN.

[M. Mennier, of Lyons, considers that vaselin diffuses itself very rapidly through the body, its diffusibility varying inversely with its consistence, and he states that antiseptics combined with it as a vehicle give rise to no local pain or reaction when injected hypodermically. It is essential, how-

ever, that the vaselin should be absolutely pure. The best test for impurity is warm sulphuric acid, which does not blacken pure vaselin.

Eucalyptol and turpentine have thus been injected, the former in phthisis, the latter in sciatica, according to the following formulæ:

Eucalyptol, ...	5 parts
Vaselin, ...	20 parts.
	(By weight.)

From fifteen minims to three drachms to be injected daily into the outer part of the thigh.

Berthelot's turpentine, . . .	75 minims
Vaselin, ...	5 drachms

Dose.—From ♏ xv. to ʒ iiss. daily.

["Berthelot's turpentine" is not known in the U. S.—R.]

Iodoform, carbolic acid, iodine, and camphor may in this form be injected in the strength of one per cent, thymol in half per cent, and menthol in ten per cent.[50]—*Trans.*]

VERATRINA.

VERATRINE.

Veratrine is obtained from the seeds of the *Sabadilla officinarum.* [*Veratrum album* L. and *Veratrum viride* Aiton, which the authors of the original quote as sources of veratrine, do *not* contain veratrine, but other alkaloids, chiefly jervine.—R.] It is insoluble in water, but dissolves in alcohol and ether. All its salts, and especially the nitrate, are soluble in water.

Doses of $\frac{1}{16}$ to $\frac{1}{4}$ of a grain suffice to produce decidedly toxic phenomena in all species of animals, man included.

Chief Physiological Effects.—It is an antipyretic. When administered by the mouth, it produces a sensation first of heat and then of burning, nausea, vomiting, colic, diarrhœa, tinglings in the limbs; the respiratory movements become infrequent and painful, the pulse, which in the first place is accelerated, becomes slow and irregular. The temperature falls, there are intense headache, involuntary muscular contractions, collapse and fainting with pupillary dilatation. Saliva-

tion and emesis are the two most constant symptoms. Linon states that the exhibition of veratrine may be persisted in despite the vomiting in cases in which the antipyretic effect has not been attained, as this effect is generally produced only after emesis. The fall in the pulse-rate always precedes the fall in temperature. Its action appears in from two to three hours after administration, and it does not accumulate in the system.

Veratrine, ...	1 grain
Diluted alcohol, ...	72 minims
Distilled water, . . .	up to 144 minims.

Two to six minims of this solution are equivalent to $\frac{1}{72}$ to $\frac{1}{24}$ of a grain of veratrine.

Therapeutic Uses.—Pneumonia (it must not be forgotten that pneumonia does not admit of vague general treatment) and neuralgia (Lorent), neuralgic and rheumatoid pains (Bois), rheumatism (Eulenburg and Hiffelsheim), toothache and neuralgic rheumatism (Erlenmeyer used it in this latter affection without benefit), continued fevers and symptomatic fever (Eulenburg and Seitz).

Prof. Eulenburg observed abscess after the injection of an alcoholic solution, 1 part in 250; and afterward he used the same strength of solution prepared with equal parts of water and alcohol. Messrs. Lorent, Erlenmeyer, Hiffelsheim, and Eulenburg were all obliged to abandon its use hypodermically owing to its local irritant effects.

M. Bois made use of a 1-per-cent aqueous solution of veratrine nitrate; he injected doses of $\frac{1}{140}$ to $\frac{1}{70}$ of a grain with success. But, he adds, "the contact of the solution with the tissues produced such intolerable pain that the remedy was found to be worse than the disease, otherwise it gave rise to no local disturbance." M. Linon in his essay (Strasburg, 1868) states that he has seen the tincture [meaning that of veratrum viride, which, however, contains *no* veratrine.—R.] administered both per os and hypodermically.

M. Hepp had prepared it by dissolving the resinous extract in alcohol of 56%, in the proportion of 5½ grains of veratrum to 160 minims of alcohol. The same author adds, a few pages further on, that this solution produced a phlegmonous abscess at the point of puncture, and that M. Hepp purposed trying a

solution of the resinous extract in glycerin, in the hope that this solution would be less irritating. Veratrine has been used by Messrs. Cagny and Leblanc in veterinary medicine (45 to 90 minims of a 1-in-25 alcoholic solution, in the horse ("Congrès de Blois," 1884).

ZINCI CHLORIDUM.

Chloride of Zinc.

M. Luton has used a 1-in-50 solution of chloride of zinc in various forms of neuralgiæ, among others in sciatica (loc. cit., p. 112).

ZINCI SULPHAS.

Sulphate of Zinc.

Sulphate of zinc has been administered hypodermically by M. Wyschinski in dilute solution in the treatment of obstinate dyspepsia.

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TABLE OF ANTIDOTES AND ANTAGONISMS.[1]

Aconite and its preparations (extract of aconite, aconitine, etc.)	Antidotes	Ammonia (used successfully by Richardson). Atropine. Brandy (or some other form of alcohol). Digitalis (10 to 20 drops of the tincture). Ether. Nitrite of Amyl. Strychnine.
Agaricin	Antidote	Atropine.
Antimony	Antidotes	Apomorphine (to induce vomiting). Morphine (after subsidence of acute symptoms).
Arsenic	Antidotes	Apomorphine. Morphine (as in poisoning by antimony).
Atropine and Belladonna	Antidotes	Apomorphine. Chloral Hydrate. Morphine.
	Antagonists	Muscarine. (?) Physostigma. Pilocarpine.
Caffeine	Antagonist	Morphine.
Calabar Bean, preparations of	Antagonists	Atropine. Strychnine.
	Antidotes	Chloral. Camphorated Oil. Ether.[2]

[1] For General Poisoning see Therapeutic Index. This table is by no means intended to be a complete toxicological chart: it simply comprises remedies which have been, or may be, used hypodermically as antidotes or antagonists. The list has been compiled from numerous works, among which may be mentioned the manual itself, Ziemssen's "Cyclopædia of the Practice of Medicine," vol. xvii.; Neale's "Digest;" and my friend Mr. Murrell's invaluable little handbook, "What to do in Cases of Poisoning," 5th Edition. There are also numerous quotations from the Lancet, British Medical Journal, Medical Times and Gazette, Practitioner, London Medical Record, and Braithwaite's Retrospect.

[2] Ziemssen, loc., cit., p. 704.

Camphor	Antidotes	Alcohol. Apomorphine. Ether.
Camphor, Monobromated	Antagonist	Strychnine.
Cannabis Indica	Antagonist	Strychnine.
Cantharidin	Antidotes	Apomorphine. Morphine.
Carbolic Acid	Antidotes	Alcohol. Apomorphine. Atropine. Ether. Nitrite of Amyl.
Carbonic Oxide	Antidote	Ergotine.
Chloral Hydrate	Antidotes	Apomorphine.[1] Nitrite of Amyl.[2]
	Antagonists	Picrotoxin. Strychnine.[3]
Chloroform	Antidotes	Ammonia.[4] Atropine. Digitalis. Ether. Nitrite of Amyl. Strychnine.
Coniine	Antagonist	Strychnine. (?)
	Antidote	Atropine. (?)
Curarine	Antidote	Strychnine.
Daturine	Antagonist	Eserine.
	Antidotes	Morphine.[5] Pilocarpine.

[1] Mentioned by Dr. Murrell, condemned by David. (See under Apomorphine.)

[2] Brit. Med. Jour., 1879, vol. i., p. 969.

[3] Levinstein asserts that strychnine is a true antidote to chloral. He reports recovery in a case of poisoning by 372 grains, after two subcutaneous injections, of $\frac{1}{12}$ and $\frac{1}{24}$ of a grain respectively, of strychnine. In a case of accidental poisoning (absorption from chloral dressings in amputation above the knee) in the Edinburgh Royal Infirmary, under the care of Dr. John Duncan, I administered three doses of $\frac{1}{12}$ of a grain each of strychnine. The patient recovered.

Husemann and Kröger recommended atropine as an antidote. (See London Medical Record, vol. xii., p. 182.)

[4] May be injected intravenously or hypodermically.

[5] Neale's "Digest," 1882 (378,5).

Digitalis and Digitalin	Antidotes . . .	Aconitine. Alcohol. Apomorphine.
	Antagonist[1] . .	Hydrochlorate of Pereirine. (?)
Duboisine	Antagonists. .	Jaborandi and Pilocarpine. Muscarine.
Emetine	Antagonist . . .	Strychnine.[2]
Ergot, Extract of, Ergotin, etc.	Antidotes . . .	Alcohol. Ammonia.[3] Camphor. Ether. Nitrite of Amyl.
Ether	Antidote	Nitrite of Amyl.
Gelsemine	Antidotes . . .	Alcohol. Atropine. Ether.
Hydrocyanic Acid . . .	Antidotes . . .	Alcohol. Ammonia. Atropine.[4] Ether.
Hyoscyamine	Antagonist . . .	Eserine partially.
Lead	Antidotes . . .	None certain. Cayoponine has been tried, but with injurious results.
Mercury	Antidote	Pilocarpine.
Morphine and Opium.	Antidotes . . .	Alcohol with Coffee.[5] Atropine.[6] Caffeine. Camphor. Cocaine.[7] Coffee (better administered per rectum). Ether. Nitrite of Amyl. Strychnine.

[1] In effects on the heart.

[2] Martindale and Westcott's "Extra Pharmacopœia."

[3] To avert cardiac paralysis.

[4] Böhm (Ziemssen, loc. cit., p. 511) says that recent experiments show that atropine cannot be recommended as an antidote.

[5] See case reported by Flood—quoted p. 352.

[6] Johnstone (Medical Times, 1872—1873) saw eleven recoveries out of seventeen cases of opium poisoning by the atropine treatment.

[7] Of great use in chronic poisoning.

Mushrooms	Antidotes	Apomorphine. Atropine.
Nicotine	Antidotes	Apomorphine. Strychnine.
Nitroglycerin	Antidotes	Atropine. Ergotin.
Picrotoxin	Antidote	Chloral.
Pilocarpine	Antidotes	Atropine. Homatropine.
Resorcin	Antidotes	Acohol. Ammonia. Atropine. Nitrite of Amyl.
Strychnine and Nux-Vomica	Antidotes	Aconitine. (?) Apomorphine.[1] Atropine. Calabar Bean. (?) Camphor. Cannabis Indica. Chloral Hydrate. Cocaine.[2] Curarine. Emetine. Eserine. Morphine. Nicotine. (?) Nitrite of Amyl.[3] Prussic Acid.[4]

[1] British Medical Journal, vol. ii., 1878, p. 374.

[2] Lancet, vol. i., 1885 p. 439.

[3] "Nitrite of amyl appears to be one of the most reliable antidotes. It may be administered hypodermically or by inhalations."—Dr. Barnes, British Medical Journal, vol. i., 1882, p. 457.

[4] Hydrocyanic acid, according to Dr. Ladell, is an undoubted antidote, but not free from danger, as, to be of any use, it must be administered in toxic doses. (British Medical Journal, vol. ii., 1883, p. 355).

HYPODERMIC POSOLOGICAL TABLE.

ACIDUM ARSENIOSUM. (See *Arsenium.*)

" BENZOICUM. ¾ to 1½ grains several times daily.

" CARBOLICUM. $\frac{1}{14}$ to $\frac{1}{8}$ of a grain.

" HYDROCYANICUM (U. S.). ½ to 2 minims of medicinal acid. (See also *Potassii Cyanidum.*)

" OSMICUM. $\frac{1}{14}$ to ¼ of a grain.

" SCLEROTINICUM. ½ to 4½ grains, increased cautiously to 9 grains.

" TANNICUM. From 16 to 32 minims of a 10 or 20 per cent solution.

ÆTHER. 16 minims and upward.

ACONITINA. $\frac{1}{120}$ to $\frac{1}{60}$ of a grain of Morson's preparation. The dose may be carefully increased up to $\frac{1}{24}$ of a grain. Duquesnel's aconitine should never be administered hypodermically.

AGARICINUM. $\frac{1}{14}$ of a grain.

ALCOHOL. No definite dose can be fixed. To be given according to urgency. (In cases of post-partum hemorrhage the translator has found benefit from 40-minim doses of brandy repeated frequently.)

ALCOHOL AMMONIATUM. 5 to 10 minims.

ALOE. 1½ grains in aqueous solution.

ALOINUM. Produces too much local irritation to be useful for hypodermic purposes.

AMMONIÆ AQUA. 2 to 5 minims.

AMYL NITRIS. 8 to 12 minims of 10-per-cent alcoholic solution.

ANTIHYDROPINUM. Sixteen minims of tincture.

ANTIMONII ET POTASSII TARTRAS. ¼ grain.

ANTIPYRINA. 25 to 30 grains at intervals of an hour, till three injections have been made. In children 1½ grains for each year of age.

APOCODEINÆ HYDROCHLORAS. ½ to ⅓ of a grain.

APOMORPHINÆ HYDROCHLORAS. $\frac{1}{16}$ to ⅛ of a grain. (To be used with caution, alarming symptoms having been caused by $\frac{1}{15}$ of a grain. 2 to 8 minims of a 2% solution.)

AQUA. In varying quantities, with or without salines, and either iced (in hyperpyrexia) or at a high temperature.

ARBUTINUM. Seldom used subcutaneously. Dose. by mouth, 15 grains; subcutaneously, 4 grains.

ARGENTI NITRAS. $\frac{1}{6}$ to $\frac{1}{3}$ of a grain.

" CHLORIDUM. $\frac{1}{14}$ of a grain.

ARSENIUM. $\frac{1}{4}$ to $\frac{3}{4}$ of a grain of arsenious acid has been injected by Lipp in cases of psoriasis and chronic eczema. 2 to 8 minims of Fowler's solution. Arseniate of sodium, $\frac{1}{36}$ to $\frac{1}{18}$ of a grain.[1]

ASPIDOSPERMINÆ SULPHAS. $\frac{3}{4}$ to $1\frac{1}{2}$ and 3 grains.

ATROPINÆ SULPHAS. $\frac{1}{140}$ to $\frac{1}{70}$ and $\frac{1}{35}$ of a grain.

AURI CHLORIDUM. $\frac{1}{35}$ of a grain.

AURI ET POTASSII CYANIDUM. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.

BROMUM. 1-minim doses, in hospital gangrene.

CAFFEINA. $\frac{1}{4}$ to $1\frac{1}{2}$ grains.

CALABAR BEAN. (See *Physostigma.*)

CAMPHORA. $1\frac{1}{2}$ to 3 grains.

CAMPHORA MONOBROMATA. $1\frac{1}{2}$ to 3 grains.

CANNABIS INDICA. 2 to 5 minims of tincture.

CANTHARIDIS TINCTURA. 10 to 20 minims

CANTHARIDINUM $\frac{1}{1400}$ to $\frac{1}{140}$ of a grain.

CEDRINUM. $\frac{1}{16}$ of a grain (maximum dose).

CHLORAL HYDRAS. $2\frac{1}{2}$ to 7 grains.

CROTON CHLORAL HYDRAS. $\frac{1}{2}$ to 4 grains. Unsuitable for hypodermic use on account of its irritant action.

CHLOROFORMUM. 15 to 40 minims.

CHRYSAROBINUM (ACIDUM CHRYSOPHANICUM). $\frac{1}{360}$ to $\frac{1}{140}$ grain.

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[1] Bartholow (loc. cit., p. 243) recommends the liquor sodii arseniatis, in preference to Fowler's solution, for hypodermic purposes, in doses of 5, 10, or even 15 minims. It is claimed for this salt that it is less irritant in its local effects, that it is less apt to produce arsenical poisoning, and that it possesses greater osmotic power than Fowler's solution. The injections are made on alternate days, and in different situations so as to minimize the local effects.

Mr. Jonathan Hutchinson thinks that the therapeutic effects of arsenic are best obtained by a combination of the arseniates of potassium and sodium.

CINCHONIDINÆ HYDROBROMAS vel SULPHAS. 1 to 8 grains.
COCAINA. $\frac{1}{4}$ to $\frac{1}{2}$ of a grain.
CODEINA. $\frac{1}{8}$ to $1\frac{3}{4}$ grains.
COLCHICINA. $\frac{1}{30}$ of a grain. [?]
CONIINA. $\frac{1}{12}$ to $\frac{1}{18}$ of a grain.
CONIINÆ HYDROBROMAS. $\frac{1}{8}$ grain.
COTOINUM. 4 grains.
CREASOTUM. 3 to 6 minims.
CROTONIS OLEUM. Unsuitable for hypodermic purposes.
CUPRI SULPHAS. Unsuitable for hypodermic purposes.
CURARE. $\frac{1}{12}$ to $\frac{1}{2}$ of a grain.
CURARINA. $\frac{1}{70}$ to $\frac{1}{14}$ of a grain.

DATURINA. $\frac{1}{120}$ to $\frac{1}{60}$ of a grain. (See *Stramonium.*)
DIASTASE. $1\frac{1}{2}$ to 3 grains.
DIGITALINUM. $\frac{1}{70}$ of a grain, cautiously increased. (Tincture of digitalis may be given hypodermically; besides causing less irritation than does digitaline, it is a safer remedy.)
DUBOISINA. $\frac{1}{140}$ to $\frac{1}{70}$ of a grain.

EMETINA. From $\frac{1}{70}$ of a grain as an expectorant, to $\frac{1}{14}$ of a grain as an emetic.
ERGOTÆ EXTRACTUM (AQUOSUM). $\frac{1}{2}$ to 1 grain.
ERGOTINUM. $1\frac{1}{2}$ to 2 grains.
ERGOTININA. $\frac{1}{30}$ of a grain.
ETHER. (See *Æther.*)
EUCALYPTOL. 15 minims and upward of a 20-per cent solution in vaselin.

FERRI PYROPHOSPHAS. $1\frac{1}{2}$ to 3 grains.
" CITRAS. 1 to 2 grains.
FERRUM PEPTONATUM. $1\frac{1}{2}$ to 3 grains.

GELSEMINÆ HYDROCHLORAS. $\frac{1}{140}$ to $\frac{1}{70}$ of a grain.
GLYCERINUM. $\frac{1}{2}$ to 1 drachm, as a substitute for cod-liver oil.
GUACHAMACÆ EXTRACTUM. $\frac{1}{4}$ of a grain.

HOMATROPINÆ HYDROBROMAS. $\frac{1}{8}$ of a grain.
HYDRARGYRI BICHLORIDUM. $\frac{1}{160}$ to $\frac{1}{60}$ of a grain.
" BINIODIDUM. $\frac{1}{14}$ to $\frac{1}{4}$ of a grain.

HYDRARGYRI CHLORO-ALBUMINAS. $\frac{1}{14}$ of a grain.
" CHLORIDUM MITE (CALOMEL). $\frac{3}{4}$ to $1\frac{1}{2}$ grains.
" CYANIDUM. $\frac{1}{14}$ to $\frac{1}{7}$ of a grain.
" GLYCOCHOLAS. $\frac{1}{14}$ to $\frac{1}{7}$ of a grain.
" ET SODII IODIDUM. $\frac{1}{8}$ of a grain.
HYDRARGYRUM CUM UREA. (See p. 434.)
" FORMAMIDATUM. 8 to 16 minims of a 1-per-cent solution.
" PEPTONATUM. $\frac{1}{7}$ of a grain.
HYDROQUINONUM. 5 to 10 minims of a 10-per-cent solution. Two injections, one into each arm, to be made simultaneously.
HYOSCINÆ HYDRIODAS (or other salts). $\frac{1}{200}$ to $\frac{1}{100}$ of a grain.
HYOSCYAMINA. $\frac{1}{100}$ of a grain.
HYPNONUM. 2 to 4 minims: is not adapted for hypodermic use.

ICHTHYOL. 16 minims of a 5 to 10 per cent aqueous solution.
INJECTIONES NUTRIENTES HYPODERMICÆ. (Oils—almond, cod-liver, and olive; sugar, milk, beef juice, defibrinated blood, blood serum, etc.) (See text.)
IODOFORMUM. 1 to 3 grains.

KAIRINA. $1\frac{1}{2}$ to 8 grains.

LITHII BROMIDUM. $\frac{3}{4}$ of a grain (unsuitable for hypodermic use).

MAGNESII CHLORIDUM. (Of little use.)
" SULPHAS. (Of little use.)
MORPHINÆ ACETAS. $\frac{1}{10}$ to $\frac{1}{3}$ of a grain.
" BIMECONAS. $\frac{1}{4}$ to $\frac{1}{2}$ of a grain.
" HYDROCHLORAS. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.
" SULPHAS. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.
" TARTRAS. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.
MOSCHI TINCTURA. 16 to 48 minims per diem.
MUSCARINA. $\frac{1}{8}$ to $\frac{1}{3}$ of a grain.

NAPELLINA. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.
NARCEINÆ HYDROCHLORAS. $\frac{1}{15}$ to $\frac{1}{4}$ of a grain.
NARCOTINA. Dose uncertain.

NICOTINA. $\frac{1}{10}$ of a grain.

NITROGLYCERINUM. 2 to 6 minims, in the 24 hours, of 1-per-cent alcoholic solution. ($\frac{1}{120}$ to $\frac{1}{60}$ of a grain.)

OLEANDRINA. 1 grain.

OLEUM AMYGDALÆ. 1 to 4 drachms. (Cod-liver and olive oils may be given in the same doses.)

" TEREBINTHINÆ. (See *Terebinthina* and *Vaselin.*)

" TIGLII. (See *Crotonis Oleum.*)

OPIUM, AQUEOUS EXTRACT AND TINCTURE OF. Not used now.

PAPAVERINÆ HYDROCHLORAS or PHOSPHAS. 6 to 12 minims of a 1 to 12 solution.

PARACOTOINUM. 1 to 2 grains.

PARALDEHYDUM. 4 minims.

PEREIRINA. $\frac{2}{3}$ to $1\frac{1}{3}$ grain.

PHYSOSTIGMA (CALABAR BEAN). $\frac{1}{4}$ to $\frac{1}{2}$ grain of extract.

PHYSOSTIGMINA (ESERINA). $\frac{1}{24}$ to $\frac{1}{8}$ grain.

PICROTOXINUM. $\frac{1}{120}$ to $\frac{1}{48}$ of a grain.

PILOCARPINÆ HYDROCHLORAS or NITRAS. $\frac{1}{12}$ to $\frac{1}{4}$ of a grain.

POTASSII BROMIDUM. $\frac{1}{2}$ a grain to 8 grains.

" CYANIDUM. $\frac{1}{32}$ to $\frac{1}{16}$ of a grain.

" IODIDUM. 1 to 8 grains.

" PERMANGANAS. $\frac{1}{4}$ to $\frac{1}{3}$ of a grain.

QUINIDINA AND ITS SALTS. Are unsuitable for hypodermic use.

QUININÆ CARBOLAS. 5 to 15 grains.[1]

" ET UREA HYDROCHLORAS. 16 minims of a 10-per-cent solution.

" HYDROBROMAS. 1 to 4 grains. Acid hydrobromate, 2 to $3\frac{1}{2}$ grains.

" SULPHAS. 1 to 4 grains.

" SULPHOVINAS. $2\frac{1}{2}$ grains.

" TARTRAS. 1 to 4 grains.

QUINOIDINA. $2\frac{1}{2}$ to 5 grains.[2]

QUINOLINÆ CITRAS.
" HYDROCHLORAS.
" TARTRAS.
} 3 to 15 grains.

[1] Has been used in cholera.

[2] Eulenburg condemns the hypodermic use of this drug.

RESORCINUM. ½ to 3 grains.

SAPONINUM. ⅛ to ¼ of a grain.
SCILLIPICRINUM. ⅓ to 1½ grains.
SODII CHLORIDUM. (See text.)
" IODIDUM. 4½ to 9 grains.
" LACTAS.[1] 9 grains.
" SALICYLAS. 1 to 8 grains.[2]
" SULPHAS. 1½ to 3 grains.
" PHOSPHAS. 1½ to 3 grains.
SOLANINA. From 1 to 3, 4, or even 8 grains daily.
SPARTEINÆ SULPHAS. ⅛ to ½ of a grain.[3]
STRAMONII EXTRACTUM. $\frac{1}{16}$ to ⅓ of a grain.
STRYCHNINÆ ARSENIAS. $\frac{1}{64}$ cautiously increased to $\frac{1}{16}$ of a grain.
" NITRAS. $\frac{1}{64}$ to $\frac{1}{28}$ of a grain.
" SULPHAS. $\frac{1}{64}$ to $\frac{1}{16}$ of a grain.

TAYUYÆ TINCTURA. 16 minims.
THALLINÆ SULPHAS. 1½ to 3 grains (repeated at frequent intervals as required).

URETHANUM. 5 grains and upward.

VALDIVINA. $\frac{1}{35}$ to $\frac{1}{17}$ of a grain.[4]
VERATRINA. $\frac{1}{12}$ to $\frac{1}{24}$ of a grain.

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[1] Not well adapted for hypodermic use.

[2] As much as 16 grains has been given in the first stage of yellow fever.

[3] Sulphate of sparteine administered hypodermically in doses of ⅛ to ¼ of a grain, in conjunction with the internal administration of nitroglycerin, has proved in the hands of Professor Ball and Dr. Oscar Jennings, of Paris, of inestimable service in the treatment of morphiomania. The indication for its use is furnished by the sphygmograph and by the feeling of depression experienced by the patient. "Lancet," 1887, vol. i., p. 1278.

[4] Maximum dose.

THERAPEUTIC INDEX OF DISEASES.

NOTE.—As the drugs in the text are arranged in alphabetical order (according to their Latin names), it will be easy to refer to the several remedies enumerated in the list of diseases.

ABSCESS.

Cocaine injected before operation.

[The effect is increased by applying a ligature above the part operated on in the first instance. Major operation have also been performed under the local anæsthetic influence of cocaine. Dr. Varick ("New York Med. Jour.," 1886) has in this way performed amputation through the thigh, and Mr. Mayo Robson, of Leeds ("Brit. Med. J.," vol. ii., 1886, p. 859), has excised a portion of the tongue ten minutes after injection of one grain of cocaine hydrochlorate without causing the slightest pain.—TRANS.]

ADYNAMIA.

Alcohol.
Ammoniated alcohol with anise.
Ammonia.
Camphor.
Musk.

AFTER-PAINS.

Chloral hydrate.
Chloral and ergotin.
Morphine.
Morphine and atropine.

AGUE (SEE FEVER, INTERMITTENT).

ALBUMINURIA.

Caffeine (inferior to other diuretics).
Cantharidin (in chronic albuminuria).
Nitrite of amyl.
Nitroglycerin.
Scillipicrin.
Scoparin.
Sparteine.

ALCOHOLISM.

Ammonia (used successfully in a case complicated with sunstroke).

ALOPECIA.

Pilocarpine.

AMENORRHŒA.

Ferruginous preparations with quinine.
Ferruginous preparations with strychnine.

ANÆMIA.

Alcohol (in form of brandy or whiskey).
Alcohol with ammonia.
Blood, human (used successfully).
Blood, human, intraperitoneal injection.
Ferruginous preparations (have succeeded by hypodermic, after failure by ordinary methods).
Nitroglycerin.
Opium, preparations of, in cerebral anæmia.

ANEURISM.

Ergot and its preparations (extract of ergot, ergotin, ergotinine).

["From ¼ to 4½ grains of watery extract of ergot dissolved in a mixture of one part of glycerin to five of alcohol, or in glycerin and water, equal parts, have been injected over or in the neighborhood of the tumor at intervals varying from half a day to several days." Cure of subclavian, radial, and even of abdominal aortic aneurism has been obtained by Langenbeck, Wolff, and others. Ziemssen's "Cyclopædia of Practice of Medicine," vol. vi., p. 452.—TRANS.]

[Fibrin-ferment, recommended by Dr. Arthur Gamgee, has been used by Mr. Southam. This treatment was unsuccessful, but Mr. Southam recommends further experiments. The ferment is injected

into the sac ("Brit. Med. Jour.," vol. ii., 1883, p. 321).—TRANS.].
Iron, preparations of, by interstitial injections.

ANGINA LUDWIGII. LUDWIG'S ANGINA. (MALIGNANT OR PHAGEDÆNIC SORE THROAT.)
Apocodeine.
Apomorphine.
Aponarceine.
Carbolic acid (interstitial injections).
Tartar emetic.
Emetine.

AGINA PECTORIS.
Aconite, preparations of (extract of aconite, aconitine).
Coniine.
Hydrocyanic acid.
Nitrite of amyl.
Nitroglycerin.
Sodium chloride.

ANUS, FISSURE OF.
Iodoform.

ANUS, PROLAPSE OF.
Ergotin.
Strychnine.

AORTA, DISEASES OF (SEE HEART DISEASES).
Nitrite of amyl.
Nitroglycerin.

APHONIA.
Strychnine (when the disease is of paralytic origin).

APPETITE, LOSS OF.
Cotoin.
Paracotoin (disadvantageous on account of its sparing solubility).
Sodium chloride (used by Lubanski to stimulate appetite and digestion in phthisis).

ARTHRITIS.
Iodoform.
Nitrate of silver.

ARTHRITIS DEFORMANS.
Aconitine.

ASCITES (SEE DROPSY).

ASPHYXIA.
Apocodeine.
Apomorphine.
Aponarceine.

ASTHMA (SEE ALSO DYSPNŒA.)
Aspidospermine.
Atropine.
Codeine.
Coniine.
Duboisine.
Hyoscine.
Morphine.
Nitrite of amyl.
Nitroglycerin.
Solanine (both in bronchial and cardiac asthma).

ATHREPSIA (INFANTILE ATROPHY).
Sodium sulphate with sodium phosphate.

ATROPHY (SEE EMACIATION).

ATROPHY, PROGRESSIVE MUSCULAR.
Strychnine.
[Arsenic and nitrate of silver hypodermically and internally, and phosphorus internally, have been used, but without encouraging results. Prof. Eulenburg has used strychnine extensively (Ziemssen, loc. cit., vol. iv., p 150), but without any benefit.—TRANS.]

BITES OF VENOMOUS SERPENTS.
Ammonia, hypodermically and intravenously.
Cedrin.
Permanganate of potassium.
Valdivine (has not proved to be of any use).

BLADDER, CATARRH OF.
Arbutin.

BLEPHAROSPASM.
Coniine.

BRIGHT'S DISEASE.
Caffeine (as a diuretic, inferior to other diuretics).
Cantharidin (in chronic forms).
Digitalin.
Nitrite of amyl, in interstitial nephritis.
Nitroglycerin, in interstitial nephritis.
[Nitroglycerin is said to diminish

albumin and to increase the diurnal quantity of urine. Rossbach asserts that it prolongs life and cuts short grave attacks.—TRANS.]

BRONCHITIS.

Benzoic acid and benzoate of sodium.
Coniine.
Solanine.
Water to which a few drops of cherry-laurel water have been added. One syringeful to be injected into the neighborhood of parts in which painful sensations are experienced.

BUBO.

Iodoform.
[Carbolic acid, chloride of ammonium, bichloride of mercury, and sulphate of copper have also been used hypodermically.—TRANS.]

CALCULI (BILIARY, RENAL AND VESICAL).

Atropine and morphine.
Morphine.

CANCER.

Aloes and aloin for constipation.
Chloroform.
Cinnamon as local stimulant.
Iodoform.

CARBUNCLE.

Carbolic acid.
Mercury (interstitial injection).

CATALEPSY.

Curare has been injected hypodermically, but without benefit. [*See* Ziemssen, loc. cit., xiv., p. 382.—TRANS.]

CATARRH.

Apocodeine.
Apomorphine.
Aponarceine.
Tincture of nux vomica in suffocative catarrh.

CHEST-PAINS.

Saponin (for intercostal neuralgia). Not adapted for hypodermic use.

CHLOROSIS.

Iron, preparations of.
Iron with arsenic.

CHOKING.

Apocodeine.
Apomorphine.
Aponarceine.
Tartar emetic.
Emetine.

CHOLERA.

Ammonia with spirit of peppermint has been used successfully.
Ammonium sulphate.
Arsenic.
Caffeine.
" with benzoate of sodium.
" " salicylate of sodium.
Camphor (Ziemssen, loc. cit., vol. xv. p. 244).
Chloral hydrate
Cotoin.
Cotoin with chloral
Ether.
Morphine before collapse.
Morphine with atropine in intermediate stages.
Atropine during collapse.
Musk.
Nitrite of amyl (of no use).
Paracotoin.
Pilocarpine with pepsin.
Potassium iodide in stage of asphyxia.
Quinine.
Quinine with carbolic acid (1st stage).
Sodium chloride ("Lond. Med. Record," vol. xiv., p. 108).
Sodium sulphate.
Strychnine (2d stage).
Tannin ("London Medical Record," vol. xiv., p. 108).
Water, subcutaneously, intravenously and intraperitoneally.
Water, with salines, morphine, opium, or camphor.

CHOREA.

Arsenic.
Atropine.
Calabar bean and its preparations.
Coniine.
Curarine.
Hyoscyamine.
[Morphine and opiates are of the greatest value in some cases.—TRANS.]

CHOROIDO-SCLEROTITIS.

Pilocarpine.

COLIC.
- Atropine.
- Atropine with morphine.
- Chloroform.
- Water (especially hot water).
- Eserine in veterinary practice.

COLLAPSE.
- Ammonia, hypodermically and intravenously.
- Ammonia with alcohol.
- Benzoic acid.
- Brandy.
- Ether (sulphuric, acetic, and Hoffmann's anodyne).
- Musk.
- Nux vomica tincture.
- Strychnine.

COMA (SEE ALSO URÆMIA).
- Ether, when coma is due to excessive hemorrhage.

CONSTIPATION.
- Aloes and aloin.
- Atropine.
- Castor oil. (Recommended by Shoemaker.)
- Croton oil (to be avoided).
- Magnesium chloride.
- Magnesium sulphate.
- Sodium sulphate.

CONTRACTURE.
- Guachamaca.
- Physostigmine (Ziemssen, vol. xiii., p. 187).

CONVULSIONS.
- Apocodeine.
- Apomorphine, and other emetics.
- Ergotin.
- Ether, in infantile convulsions at beginning of a pneumonic attack.
- Quinine.

CONVULSIONS, PUERPERAL.
- Potassium bromide.

[Chloral has frequently been administered subcutaneously with marked success; morphine, nitrite of amyl and pilocarpine have also been used.—TRANS.]

COUGH.
- Agaricin, useful in phthisis.
- Coniine.
- Cherry-laurel water.
- Ergotin.
- Cannabis Indica, in phthisis.
- Homatropine, in phthisis.
- Morphine with tartar emetic.

CROUP.
- Apomorphine and other emetics.
- Calomel.
- Cystitis.
- Solanine.

DELIRIUM TREMENS.
- Digitalin.
- Strychnine.

[Opium, morphine, and hyoscyamine have also been given subcutaneously. Some authors speak of strychnine as a specific.—TRANS.]

DIABETES INSIPIDUS. POLYURIA.
- Ergot and its preparations, especially ergotin.
- Pilocarpine.

DIABETES MELLITUS.
- Carbolic acid.
- Codeine. (*See* Ziemssen, loc. cit., xvi., 994.)
- Diastase.
- Ergotin.
- Morphine.

DIARRHŒA.
- Cinnamon.
- Cedrin (in chronic diarrhœa).
- Cotoin (except when diarrhœa is due to ulceration, alcoholism or cirrhosis).
- Opium.
- Resorcin.
- Sodium chloride in phthisis (acts by stimulating appetite and digestion).

DIPHTHERIA.
- Benzoate of sodium.
- Carbolic acid.
- Apomorphine and other emetics.
- Mercury, preparations of.
- Permanganate of potassium.
- Pilocarpine.

DROPSY.
- Antihydropin.
- Caffeine (in dropsy associated with fatty degeneration of the heart).

[Digitalin.—TRANS.]
- Ether.
- Pilocarpine.

DYSENTERY.

[Camphorated oil (Ziemssen, loc. cit., vol. i., p. 567).—TRANS.]

DYSPEPSIA.

Apomorphine.
Physostigmine in veterinary practice.
Sodium chloride in phthisis.
Solanine.

DYSPHAGIA (OF PHTHISIS).

Cocaine.

DYSPNŒA.

Aspidospermin.
Coniine.
[Morphine is of special use, according to Dr. Beckart, in those forms of asthmatic dyspnœa associated with œdema of the lungs, as it occurs in the obese and the cachetic, and in those suffering from valvular lesions of the heart, from gout, and from renal disease. (uræmic asthma). "In these circumstances the injection of ¼ of a grain of morphine acts like a charm." Brit. Med. Jour., vol. ii., 1880, p. 80.—TRANS.]
Nitrite of amyl.

DYSURIA.

Scoparin.
Sparteine.

ECLAMPSIA.

Coniine.
Hydrocyanic acid.
Hydrate of chloral.
Hyoscine.
Musk (especially in infants).
Nitroglycerin.
Pilocarpine.

ECTHYMA.

Ichthyol.
Iodoform.

ECZEMA.

Arsenic (in chronic forms).
Chrysophanic acid.
Ichthyol.

ELEPHANTIASIS.

Mercury by interstitial injections.

EMACIATION.

Defibrinated blood.
Oils (almond, cod-liver, and olive).
Peptones.
Solution of sugar.

EMPHYSEMA.

Apomorphine (when there is bronchitis).
Coniine.
Daturine.
Solanine.
Strychnine.

ENURESIS.

(*See* Incontinence.)

EPILEPSY.

Apomorphine.
Arsenic.
Atropine.
Camphor (see Medical Times and Gazette, vol. ii., 1878, p. 108).
Coniine.
Curarine.
Napelline.
Nitrite of amyl.
Nitroglycerin.
Oleandrine (used unsuccessfully).
Pilocarpine.
Potassium bromide.
Saponin (of doubtful efficacy).

EPILEPTIFORM NEURALGIA.

Morphine.
Nitrite of amyl.
Nitroglycerin.

EPISTAXIS.

Ergotin.

ERYSIPELAS.

Carbolic acid.
Quinine.
Quinoline.
Resorcin ("London Medical Record," vol. xi., pp. 15, 196).

EXOPHTHALMOS.

Duboisine.
Ergotin and ergotinine (Braithwaite's "Retrospect," vol. xc., p. 128).

FEVER.

Antipyrine.
Aspidospermin.
Cedrin.
Coniine
Kairine (not to be used when

there is diminished hæmatosis).
Pereirine.
Quinine hydrobromate.
Hydroquinone.
Sodium salicylate.
Strychnine arseniate.
Thalline.
Veratrine.

FEVER, INTERMITTENT.
Aconitine.
Arsenic.
Carbolic acid with quinine.
Cedrin.
Ether with quinine.
Iodoform.
Pereirine.
Pilocarpine.
Quinine.
Quinoline.

FIBROIDS, UTERINE.
Cornutin.
Ergotin.
Sclerotinic acid.

GANGRENE.
Bromine.
Iodoform.

GASTRALGIA.
Hydrocyanic acid.
Iodoform.
Morphine.
Potassium iodide.
Strychnine.

GASTRIC ULCER.
Milk and beef juice alternately, 1 drachm every two hours used with success.
Dog's and chicken's blood.
Morphine.
Potassium iodide.

GLANDULAR ENLARGEMENTS.
Iodoform.
Potassium iodide.
Saline solutions.

GLAUCOMA.
Aloes and aloin (recommended by Klein to diminish inflammation and tension).

GOITRE.
Iodoform.

GOUT.
Cedrin.
Colchicine.
Nitrate of silver.

GUMMATA, INTERDIGITAL.
Iodoform.

HÆMATEMESIS.
Ergot (extract), ergotin, ergotinine.
Sclerotinic acid.

HÆMATURIA.
Ergotin.

HÆMOPTYSIS.
Apomorphine.
Atropine (of great value) ("Brit. Med. Jour.," vol. i., 1887, p. 842).
Ergotin (in phthisis without pyrexia).
Phosphoric acid.
Sclerotinic acid.

HÆMORRHAGE.
Alcohol.
Atropine (said by Tacke to be better than ergot).
Ergotin and ergotinine.
Ether (specially useful in cases of placenta prævia and post-partum hemorrhage).

HÆMORRHOIDS.
Ergotin.

HEADACHE (INCLUDING MIGRAINE).
Aconitine.
Antipyrine ("Brit. Med. Jour.," vol. i., 1887, p. 1177).
Caffeine
Cocaine.
Ergotin and ergotinine.
Nitrite of amyl.
Nitroglycerin.

HEART DISEASES.
Caffeine.
Convallaria majalis.
Digitalin.
Hyoscyamine.
Hyoscine hydriodate.
Nitrite of amyl.
Nitroglycerin.
[Dr. Mitchell Bruce ("Practitioner," vol. xxxvii., p. 324) reports a case of double aortic disease with cardiac dilatation, dropsy and albuminuria, in which hydriodate

of hyoscine was administered to control the wandering delirium. Compensation was practically re-established.—TRANS.]

HECTIC FEVER.
Aspidospermine (of doubtful efficacy).

HERNIA.
Caffeine.

HERPES ZOSTER.
Chloroform.
Morphine.

HYDROPHOBIA.
Atropine.
Cannabis indica.
Cedrin.
Curarine.
Hyoscyamine.
Hyoscine hydriodate to control spasms and produce sleep.
[Morphine subcutaneously over laryngeal nerve (Neale, "Practitioner," vol. ii., 1881, p. 218).
Morphine with atropine ("Lancet," vol. i., 1885, p. 525).
Physostigmine ("Lancet," vol. i., 1878, p. 862).—TRANS.]
Pilocarpine (useless).
Potassium bromide.
Quinine.

HYSTERIA.
Caffeine.
Coniine.
Gold chloride (in hysterical anæsthesia).
Nitrite of amyl.
Nitroglycerin.
Valerianate of ammonium.

HYSTERO-EPILEPSY.
Apomorphine.
[See case reported by Williams, "Med. Times and Gaz.," vol. ii., 1883, p. 655.—TRANS.]

INCONTINENCE OF URINE.
Atropine.
Benzoic acid (Neale's "Digest," Appendix, 1048.2).
Physostigmine.
Cantharidin.
Chloral hydrate (Neale's "Digest," 1048.2).
Ergotinine.
Strychnine.

INFLUENZA.
Apomorphine.

INSANITY.
Aloes (watery extract and aloin used by Kohn in constipation in the insane without any benefit).
[Cannabin tannate of Merck for insomnia.—TRANS.]
Codeine.
[Digitalin. Used by Sheppard in doses of $\frac{1}{8}$ to $\frac{1}{4}$ of a grain ("Med. Times and Gaz.," vol. ii., 1872, p. 482).—TRANS.]
Hyoscine hydriodate in various forms of insanity characterized by wild or restless delirium and insomnia. This comparatively new remedy has, so far, yielded excellent results.
Hyoscyamine.
Morphine.

INSOMNIA.
Caffeine, in alcoholic insomnia without delirium.
Cannabin tannate.
Cannabis Indica, useful in phthisical, not of much use in other forms.
Croton chloral (uncertain).
Chloroform.
Guachamaca.
Homatropine, in insomnia of phthisis.
[Hyoscine hydriodate in $\frac{1}{100}$ to $\frac{1}{60}$ and $\frac{1}{75}$ of a grain doses.—TRANS.]
Morphine.
Napelline.
Opium in insomnia due to cerebral anæmia.
Paraldehyde.
Potassium bromide.
Solanine.
Urethane.

KERATITIS.
Aloes and Aloin.

LABOR.
Cedrin.
Chloral hydrate. [Especially in cases of rigid os.—TRANS.]
Chloral hydrate with ergotin.
Cornutin.
Ergot (extract of), ergotin, ergotinine.

Morphine.
Morphine with atropine } [To stop ineffectual pains.—TRANS.]
Sclerotinic acid.

LARYNGISMUS STRIDULUS.
Apomorphine.
Coniine.

LARYNGITIS.
Apocodeine, apomorphine and other depressants and vomitives.
Coniine (to relieve spasm).
Morphine.
Mercury (especially in specific form). (*See* Croup.)

LICHEN.
Arsenic (especially in lichen ruber).
Chrysarobin.

LIGHTNING PAINS.
Morphine.
Pilocarpine.
Sodium salicylate. [Better by internal administration as recommended by Dr. Bvrom Bramwell.—TRANS.]
Strychnine.

LOCOMOTOR ATAXY.
Arsenic (Ziemssen, vol. xiii., p. 615).
Ergot, preparations of (Ziemssen, vol. xiii., p. 615).
Hyoscyamine.
Morphine (*see* Lightning Pains).
[Nitrite of amyl, "Practitioner," vol. ii., 1878, p. 218.—TRANS.]
Silver, salts of.
Strychnine. [Erb (Ziemssen, vol. xiii., p. 615) considers the use of this alkaloid objectionable.—TRANS.]

LUMBAGO.
Antipyrine ("Brit. Med. Jour.," vol. i., 1887, p. 1177).
Atropine.
[Carbolic acid, "Med. Times and Gaz.," vol. ii., 1875, p. 343.—TRANS.]
Cherry-laurel water.
Chloroform.
Ether ("Med. Times and Gaz.," vol. ii., 1882, p. 429, and "Brit. Med. J.," vol. i., 1883, p. 511).
Hyoscyamine.
Morphine.
Napelline.
Nitrite of amyl (in one case it produced convulsions).
Sodium chloride.

LUNG, ACUTE DISEASES OF.
Aconitine in early stages.

LUPUS.
Arsenic.
Mercuric chloride ("Lancet," 1887, vol. ii., p. 75).
Sulpho-ichthyolate of sodium intracutaneously.

LYMPHOMA.
Arsenious acid.

MANIA.
Apomorphine.
Chloral hydrate.
Curarine (of no use).
Hydrocyanic acid.
Hyoscyamine and hyoscine hydriodate.
Quinine.
[The following remedies have also been used:
Atropine,
Cannabis tincture,
Cocaine,
Coniine,
Daturine,
Digitalin.—TRANS.]

MELANCHOLIA.
Caffeine.
Cocaine.
Hydrocyanic acid.
Paraldehyde.
[Hyoscine hydriodate is useful in melancholia with insomnia.—TRANS.]

MÉNIÈRE'S DISEASE.
[Quinine by internal administration recommended by Prof. Charcot ("Lectures on Diseases of the Nervous System," New Syd. Soc. Trans., vol. ii.), might be tried hypodermically in the form of hydrobromate.—TRANS.]
Nitroglycerin.

MENINGITIS.
Curarine.

METRORRHAGIA.

Ergotin.
[Strychnine is a most effectual remedy in most forms of uterine hæmorrhage.—TRANS.]

MORPHINE HABIT.

[Cocaine, in $\frac{1}{4}$ grain doses of great value ("London Medical Record," vol. xiii., p. 107).—TRANS.]
Tincture of nux vomica.
Hydrobromate of quinine.
Sparteine sulphate of great value ("Lancet," vol. i., 1887, p. 1278).

MULTIPLE SCLEROSIS.

[Arsenic, Hyoscyamine Nitrate of silver, } Ziemssen, loc. cit., vol. xiii., p. 512.- TRANS.]

NÆVUS.

Absolute alcohol.
Carbolic acid.
Iron (by interstitial injections).

NEURALGIA.

Aconitine (of special use in neuralgia of the trigeminal).
Arsenic.
Atropine. [This alkaloid was regarded by Anstie as the remedy, *par excellence*, in abdominal pains and pelvic neuralgia.—TRANS.]
Atropine with morphine.
Caffeine.
Carbolic acid.
Cedrin.
Chloral hydrate.
Croton-chloral.
Chloroform (in trigeminal neuralgia).
Cocaine.
Codeine (of doubtful efficacy).
Colchicine.
Coniine.
Daturine.
Ergotin and ergotinine.
Gelsemine.
Hyoscyamine (uncertain).
Iodoform.
Morphine.
Napelline in hysterical and lumbo-sacral neuralgia).
Nitrite of amyl.
Nitroglycerin.
Osmic acid (uncertain in its effects).
Quinine.
Quinoline.
Saponin.
Sodium chloride.
Solanine.
Thebaine.
Veratrine.
Water.
Zinc chloride.

ORSTRUCTION, INTESTINAL.

Atropine.

ŒDEMA (SEE DROPSY).

ŒDEMA, MALIGNANT.

Carbolic acid.

OVARIOTOMY.

Ether for lowered temperature after operation.

PAIN.

Alcohol.
Atropine.
Atropine with morphine.
Cantharidin.
Chloroform.
Cocaine for local pain.
Iodoform.
Morphine.
Water.

PALPITATION.

Aconitine.
Atropine.
Nitrite of amyl.
Nitroglycerin.

PARALYSIS.

In hemiplegia and paraplegia of old-standing, in facial and radial paralysis, and in paralysis of the vocal cords and of the crico-thyroid muscle, strychnine. In glosso-labio-laryngeal paralysis, picrotoxine.

PARALYSIS AGITANS.

Arsenic.
Curarine (*see* Ziemssen, loc. cit., vol. xiv., p. 409).
Daturine.
Hyoscyamine.
Morphine.

PARTURITION (see LABOR).

PERSPIRATION, EXCESSIVE.

Aconitine.
Agaricin (especially in the night

sweats of phthisis, in which, however, it is inferior to atropine).
Atropine.
Cotoin.
Duboisine.
Homatropine hydrobromate. (according to Dr. Murrell this is of less use than atropine).
Hyoscyamine (to control sweating in phthisis and intermittent fever).
[Muscarine ("Practitioner," vol. xxv., p. 89).
Nitrite of amyl ("Practitioner," vol. ii., 1879, p. 97).—TRANS.]
Picrotoxin.
Pilocarpine.
Physostigma, preparations of.
[Quinine ("Brit. Med. Jour.," vol. i., 1878, p. 952).—TRANS.]

PERTUSSIS.

Aconitine.
[Atropine, "Lond. Med. Rec.," vol. viii., p. 308.—TRANS.]
Coniine.
Quinine.
Quinoline.
[Resorcin has been used successfully as a topical application to the rima glottidis, but it does not appear to have been used hypodermically as yet.—TRANS.]

PHTHISIS.

Benzoate of sodium.
Carbolic acid.
Cotoin (when excessive diaphoresis).
Creosote.
Eucalyptol and other microbicides ("Brit. Med. Jour.," 1887, vol. i., p. 588).
Iodoform.
Quinine hydrobromate.
Water injected over larynx to relieve cough and irritation.

PLACENTA, RETAINED.

Nitrite of amyl ("Brit. Med. Jour.," vol. i., 1882, p. 457).

PLEURISY.

Caffeine when there is effusion (of doubtful efficacy).
Cherry-laurel water.
Coniine.
[Morphine, in acute pleurisy to relieve pain.—TRANS.]
Pilocarpine.

PLEURO-PNEUMONIA.

Carbolic acid

PNEUMONIA.

Apocodeine, Apomorphine, Aponarceine } as depressants.
Antimony.
Antimony with morphine.
Benzoic acid, used successfully by Rohde in a case of imminent danger.
Coniine.
Pilocarpine.
Quinine and Quinoline.
Strychnine.
Veratrine.
[Antipyrine has often been given with marked benefit per os, but as yet it has not been administered hypodermically in pneumonia.—TRANS.]

POISONING, GENERAL.

Apomorphine. (This remedy is to be avoided in poisoning by chloral, chloroform, and morphine.)
Emetine.
Tartar Emetic.
(*See* also Table of antidotes and antagonisms.)

PROSOPALGIA.

Aconitine.

PROSTATE, ENLARGEMENT OF.

Iodoform.

PRURIGO.

Carbolic acid.
Chrysarobin.
Solanine.

PSORIASIS.

Arsenic.
Chrysarobin.

PTOSIS.

Calabar bean, extract of, and physostigmine.
[Strychnine recommended by Erb (Ziemssen, loc. cit., vol. xi., p. 486).—TRANS.]

PUERPERAL FEVER.

Aconitine.

Ammonia by intravenous injection.
Antipyrine.
Arsenic (of doubtful value).
Benzoate of sodium.
Carbolic acid (of no use).
Eucalyptol.
[Quinine hydrobromate.—TRANS.]
Thalline.

PUPURA HÆMORRHAGICA.

Ergotin.

PUSTULE, MALIGNANT.

Carbolic acid.
[According to some recent researches of Dr. Klein ("Practitioner," vol. xxxiv., p. 233), it appears that carbolic acid is neither the only nor the most efficient germicide. He found that phenylpropionic and phenylacetic acids exert a powerfully destructive influence on the bacilli of anthrax, though they have no effect on the spores. The practical value of these agents in anthracoid diseases has not yet been tested.—TRANS.]
Iodine.

PYÆMIA.

Carbolic acid ("Lancet," vol. i., 1885, p. 784).
Cedrin.
Quinine and quinoline.

RETENTION OF URINE.

Ergotin.
[I have found injections of atropine and morphine useful.—TRANS.]

RHEUMATIC ARTHRITIS.

Colchicine.
Potassium iodide (of little value).
[Quinine salicylate in the hands of Dr. Pollock and others has yielded good results by internal administration. Owing to its sparing solubility it is not adapted for hypodermic use.—TRANS.]

RHEUMATISM, ACUTE.

Aconitine.
Antipyrin.
Carbolic acid (may be discarded now for salicylic acid).
Colchicine.
Ichthyol.
Morphine.
Quinine.
Pilocarpine.

RHEUMATISM, CHRONIC.

Aconitine.
Arsenic [I have used two-drop doses of Fowler's solution with four grains of sodium salicylate hypodermically in one case of chronic rheumatism with considerable benefit.—TRANS.]
Atropine.
Colchicine.
Ichthyol.
Napelline.
Nitrate of silver.
Quinine.
Veratrine.
Water.

RETINA, DETACHED.

Pilocarpine.

RICKETS.

Iodoform.

RUPIA.

Arsenic.
Iodoform.
(Mercury in rupia syphilitica.)
Quinine.

SALIVATION.

Atropine.
Cotoin and paracotoin.

SARCOMA.

Arsenic, in general sarcoma of the skin.
Turpentine by interstitial injections.

SCIATICA.

Cantharidin (of little use).
Chloroform, in obstinate cases.
Colchicine.
Creosote with morphine.
Ergot.
Ether.
Hyoscyamine (unsatisfactory).
Morphine.
Napelline.
Resorcin.
Saponin.
Sodium chloride.
Solanine.
Strychnine.
Turpentine (of no use).
Water, iced.

Zinc chloride.

[To the above list may be added:

Atropine.

Atropine with morphine.

Nitrate of silver.

Osmic acid (see Neale's "Digest," Appendix, 1237.6 and 1240.3.) See also a report of some experiments by Fränkel, extracted from the "Berliner klin. Wochenschrift," 1884, No. 15, in the "Practitioner," vol. 34, p. 48. It appears from these experiments that although the effects of osmic acid are local, they are permanent (the axis cylinders are stained by osmic acid during life in the same way as after death), and caution in its use is therefore necessary.

Quinine and morphine.

Water.—TRANS.]

SCROFULA.

Iodoform.

Pereirine hydrochlorate.

Tayuya (said to have yielded marvellous results in the hands of some Italian physicians. These results have not been obtained by German and other investigators).

SHOCK.

Alcohol.

Ammoniated alcohol.

Ether and Hoffmann's anodyne.

SMALL-POX.

Ether, in collapse.

Opium and ether ("Lond. Medical Record," vol. xiv., p. 112).

SPASM.

Coniine.

Solanine.

SPHINCTERS, PARALYSIS OF.

[Strychnine. Recommended by Erb, Ziemssen, vol. xiii., p. 189. —TRANS.]

SPINAL CORD, DISEASES OF.

The following list is chiefly compiled from Professor Erb's valuable treatise in Ziemssen, loc. cit., vol. xiii. Most of the remedies enumerated have been used, and all of them may be used, hypodermically in diseases of the cord.

Arsenic. Improves general nutrition and exerts a tonic influence on the nervous system.

Atropine. Has been recommended by Brown-Séquard in fluxionary hyperæmia.

Coniine. Controls reflex spasm.

Curarine. Is so uncertain in its effect that it should be discarded.

Ergot and ergotin. Useful in fluxionary hyperæmia and paraplegia. Dose of the watery extract $\frac{1}{4}$ to $1\frac{1}{2}$ grains hypodermically.

Gold and sodium chloride. The precise mode of action of this remedy on the spinal cord is, as yet, unknown.

Nitrate of silver. Is of the greatest use in the various forms of sclerosis of the cord.

Quinine in spinal pains and weakness and in affections of the cord having a malarious origin.

Physostigmine and physostigma extract are used in cases of exaggerated reflex action, *e.g.*, tetanus, strychnine poisoning, and reflex contracture.

Strychnine nitrate in doses of $\frac{1}{75}$ to $\frac{1}{4}$ of a grain; to be used only in old cases of paralysis, or "when the principal lesion has been repaired without a full recovery of function." It is positively injurious in tabes, myelitis, and irritative diseases.

SPLEEN, ENLARGEMENT OF.

[Arsenic. Peiper, of Greifswald, has used parenchymatous injections of a whole syringeful of Fowler's solution, about once a week, in cases having a malarial origin. This method cannot be used in leucocythæmia or in the hæmorrhagic diathesis ("London Medical Record," vol. xii., p. 161).

Quinine (Neale's "Digest," 1882, 989.4)—TRANS.]

Quinoidine.

SPRAIN.

Sodium chloride.

SUNSTROKE.

Ammonia, in a case complicated with alcoholism.

[Antipyrine (3-grain doses in a 50-per-cent solution; causes little or no irritation). See two interesting cases recorded by Dr. Westbrook ("Med. Times and Gazette," 1885, vol. ii., p. 410). In one of these cases after the injection of 3 grains

of antipyrine the temperature fell in 35 minutes from 110° to 101°. —TRANS.]

Quinine.

SYNCOPE.

Alcohol.
Ammonia.
Ether.
Nitrite of amyl.
Nitroglycerin.

NOTE. [Nitrite of amyl and nitroglycerin will prove of service in those cases of syncope which are due to spasm of the vessels of the surface, and are characterized by small pulse and labored action of the heart. This condition is sometimes seen in anæsthesia produced by ether, and, if not promptly treated, is one of imminent peril. In experiments on rabbits I have found that this effect of ether (which is very apt to occur in these animals) is quickly overcome by the administration of amyl nitrite. These phenomena probably find their explanation in the effects produced by various agents on the depressor fibres of the vagus nerve. Cyon has shown that the function of these fibres is to transmit impressions from the heart to the vaso-motor centre, so as to inhibit the action of this centre and thus cause dilatation of the smaller vessels. Now, if ether causes contraction of the smaller vessels while at the same time it paralyzes the depressor fibres, it follows that the heart will become fatigued by its efforts to force blood into the larger vessels where there is great arterial tension. The effect of amyl nitrite is to antagonize this action of ether.—TRANS.]

SYPHILIS.

Calomel.
Gold chloride.
Iodoform.
Metallic mercury.
Mercury bichloride with atropine. Mercury bichloride with cocaine.
Mercury bichloride with morphine.
Mercury bichloride with sodium chloride.
Mercury biniodide.
Mercury with blood serum.
Mercury formamidate (in mild cases).
Mercury glycocholate.
Mercury with urea.
Pilocarpine.
Potassium and gold double cyanide.
Potassium iodide (of doubtful efficacy).
Potassium iodide with morphine.
Sodium iodide.
Tayuya.

TABES SPINALIS (see LOCOMOTOR ATAXY).

TEETH, DISEASES OF (TOOTHACHE).

Chloroform (must be used wth caution).
Cocaine, occasionally useful.
Iodoform.
Veratrine.

TETANUS.

Aconitine.
Atropine. (Administered successfully by, among others, Mr. Greenwood, in doses of $\frac{1}{60}$ to $\frac{1}{30}$ of a grain every six hours, see "Lancet," '83, vol. ii., p. 725).
Calabar bean, extract of, or physostigmine.
Cannabis Indica.
Chloral hydrate.
Coniine.
Curarine.
Daturine.

[Morphine (combined with internal administration of nitrite of amyl) used successfully by Dr. Dunlop of Glasgow ("Lancet," 1882, vol. i., p. 481). Morphine injections by themselves were tried unsuccessfully as far back as 1859 by C. Hunter (Braithwaite's "Retrospect," vol. xxxix., p. 56).—TRANS.]

Narcotine.

TIC, CONVULSIVE.

Curarine.

TREMOR.

Arsenic.
Calabar, extract (of little use).
Chloral hydrate.
Daturine.
Hyoseyamine.
Morphine.

TRISMUS NEONATORUM.
Physostigmine.

TUBERCULOSIS.
Cannabis Indica (in chronic form).
Carbolic acid.
Quinine.
Quinoline.

TUBERCULAR INTERMITTENT FEVER.
Quinine.

TUMORS.
Cocaine, as a local anæsthetic before operation.
Osmic acid, } by interstitial in-
Turpentine, } jection.

TYPHOID FEVER.
Ammonia, solution of, in collapse ("London Medical Record," vol. xiii., p. 286).
Ammonium carbolate and carbolic acid.
Antipyrine.
Aspidospermine.
Ether in adynamia.
Eucalyptol and other microbicides ("Brit. Med. Jour.," 1887, vol. i., p. 588.)
Milk, dilute, acts both as a nutrient and an antipyretic.
Musk, in adynamia.
Quinine and quinoline.
Sodium salicylate (as a rule unsafe).
Strychnine arseniate.
Water, iced.

TYPHUS FEVER.
Ammoniated alcohol (in adynamia).
Benzoic acid, quinine and urea hydrochlorate.

ULCERATION (CANCEROUS AND SYPHILITIC).
Iodoform.

URÆMIA.
Antihydropin.
Benzoic acid.
[Morphine, to control convulsions, has been used successfully in a child of 6 years ("Brit. Med. Jour.," 1885, vol. ii., p. 700).
Pilocarpine. In two cases of post-scarlatinal convulsions in children I have used nitrate of pilocarpine with the happiest results—TRANS.]

URTICARIA.
Benzoate of sodium.
Chrysarobin.

VAGINISMUS.
Atropine.
Cocaine.

VARICES.
Ergotin interstitially.

VOMITING.
Atropine.
Hydrocyanic acid.
Iodoform.
Morphine.
Sodium sulphate.
Solanine.
Zinc sulphate.
Water.

WORMS.
Cedrin.

WOUNDS, SLUGGISH.
Iodoform.

WRITER'S CRAMP.
Strychnine.

CONGESTIVE NEURASTHENIA

OR

INSOMNIA AND NERVE DEPRESSION.

BY

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9—36

CONGESTIVE NEURASTHENIA.

I THINK it desirable here to explain that this brochure does not profess to be a complete and systematic treatise on the subject of neurasthenia, nor of insomnia and nerve depression. Its purpose is to describe the special characters of a common type of nerve derangement, to prove that the insomnia and depression in this type are dependent on cerebral congestion, and to illustrate the remarkable efficacy of blood-letting, either by leeching or venesection, in its treatment. Hence, it should be understood on the one hand, that I am not describing every variety of insomnia, nor on the other is my description inclusive of every class of case benefited by leeching. The remedy has rarely fallen short of my anticipations in selected cases, but has very often exceeded them to such an extent that I have felt impelled to bring some of my experience before the profession, a step which I trust will be fully justified by the clinical evidence recorded in these pages.

In the course of practice there come frequently under observation, cases characterized by a vague set of subjective symptoms, not always clearly definable by the patient, not very urgent if judged by pain or by any objective signs, which may, indeed, be entirely absent. Yet an individual so suffering may be incapacitated from his employment; he may cease to appreciate the pleasures and comforts of life, and have no real interest in what has previously absorbed him. His subjective feelings may express a distress which he himself cannot describe, and which he expects no one else to appreciate or understand. These cases vary in severity from the lightest depression and sense of effort on exertion to the most aggravated forms of melancholia verging on the borderland of insanity.

They are classed in various categories, such as nerve debil-

ity, nervousness, melancholy, hysteria, hypochondria, neurasthenia, dyspepsia, liver derangement, etc. The treatment is characterized by its variety, and in a large proportion of cases by its uselessness. Many are sent sea-voyages and continental journeys, which nearly always improve the health, even though they fail to cure the disease. The recommendation is safe, as the patient on his return usually says he is better (not well), and so far justifies the advice.

As for the medicinal treatment, it includes all the remedies ever discovered for a disordered stomach, others intended to act on the nervous system, some of which are calmative or sedative, such as the bromides, chloral, opium, etc.; others are tonic, such as strychnine, nux vomica, arsenic, zinc, and other metals. Iron is often used most indiscriminately; alcohol is recommended by one and condemned by another. Hence, the patient often comes with a pile of prescriptions bearing the marks of travel and age: he speaks of one agreeing with him or doing him good, but the majority are of no service.

The semi-hysterical aspect of these cases, both male and female, is such as to mislead the bulk of medical advisers, who, finding the patient physically sound, and often of ruddy aspect, look upon the symptoms as trivial, the patient as nervous and fussy, and think they have done all that can or need be done in giving ten minutes discourse to demonstrate the groundless nature of his feelings, prescribing the usual bromide, thinking no more of the matter until the worrying patient again returns with the same old tale, until the doctor has hardly a fresh prescription to write, and ceases to interest himself in the case.

As above remarked, the symptoms are subjective, and as there is often no departure from the aspect of health, friends are unsympathetic; the patient is often aggravated by insinuations that there is nothing the matter, that he can work if he likes, that he gives way, that he makes no effort, and that he could throw it all off if he tried.

Dr. Broadbent speaks clearly on this point in describing cases of nerve depression with loss of arterial tension, in which the most varied treatment failed to cure. He writes, "they may have very high color, associated with a number and variety of symptoms of which I can give you no idea. No patients are to be more pitied than some of these, who, looking

to the uninstructed eye, the picture of health, are the victims of misery from which actual pain would be an agreeable distraction. What makes it worse is that so little can be done for their relief. These cases are in special danger from alcohol." ("Lancet," 1875.)

It will be my purpose in these pages to define the symptoms of one type of these nerve cases in some detail, and to expound the principles of a rational and most successful treatment. No routine plan can be discovered uniformly applicable to so mixed a class, and each individual case has to be studied on its own merits. The most serious, and a very common error is to regard the symptoms as imaginary, and lead the patient's friends to believe that there is "*nothing the matter.*" This is a cruel injustice often inflicted on these patients; they are keenly sensitive to any imputation on the honesty of their statements, and as they often think that no one has the same suffering as themselves, this scepticism of their advisers aggravates their despondency by convincing them that as their case is not understood, it must therefore be incurable. The diagnosis of "nothing the matter" is common in these cases, and I have known the same asserted where serious organic disease existed in an early stage. I had not been long in practice before I became acquainted with several serious endings to cases that had been diagnosed as hysteria and accordingly pooh-poohed. One became the victim of spinal disease, another became insane, another died of phthisis, another of hip-joint disease. These and many other cases of serious organic disease have been pronounced hysterical and nervous in the premonitory stage, and in the class of cases now under consideration there is a small proportion whose symptoms may be traced, on thorough examination, to some slight organic defect, as in a case referred to subsequently, where an accumulation in the cæcum was discovered.

I will now narrate a case which will serve to illustrate more precisely the features of the malady to which I invite attention, and show how a little clinical observation led to a rational and rapidly successful treatment in an extreme case which had over a period of years proved intractable to the best devised measures.

The subject was a gentleman, æt. 35, whose position and occupation afforded the greatest opportunities for relaxation;

who, to full manhood had been exempt from all illness, whose family history was exceptionally good, who had no apparent predisposition to disease, who was well and strongly built, and had been accustomed to riding, rowing, and other healthy exercises, whose disposition was naturally most cheerful, and who had no real care or anxiety to affect him, whose life was eminently moral and unblemished by secret follies, yet, without any apparent reason or adequate cause, beyond the strain of his ordinary occupation, he became the subject of such depression and misery, as to render his life an absolute blank for a time in regard to all pleasurable emotion.

When urged to consult me, he assented, but when I called he refused to see me on the ground that he had seen so many doctors, and there could be no hope of benefit in further advice, and I left the house with an apology and a guinea. Being induced to relent I again called. At first sight, putting aside the anxious, careworn expression of countenance, he would have passed as a healthy robust subject, about 34 years old. His manner was nervous, not in the sense of timidity, but of irritability and restlessness; he spoke hastily, and when once the subject of his health was introduced, he betrayed an eagerness to acquaint me with every detail.

He gave me the history of a nerve depression which had been coming on for years, but which for twelve months had incapacitated him from business. He had consulted the most eminent men in London, and by advice had spent several months abroad. He had taken all sorts of medicines, but knew of nothing which had proved of benefit, he spoke of the bromides as having been prejudicial to him from the quantity he had taken. He vividly described his symptoms, his hopeless state of despondency, and his inability to throw it off. There was no deficient power of reasoning on his own case, he was extremely conscious of his nerve weakness, and readily admitted how groundless and unreasonable his depression was. He owned to having no interest in anything but his own wretched condition, no pleasure or recreation could divert his thoughts more than momentarily, his misery haunted him night and day. He could not converse on any subject because he had not the power of concentrating his attention on it. He knew the folly and weakness of this, and the patient manner in which he would listen to friendly remonstrance, or an

exhortation to rouse himself, "to make an effort" as the saying is, would inspire his councillor with a confident hope that he was doing some good, but no sooner was the tone of assurance suspended, than he would again sink into the "slough of despond." Hence, he readily grasped my assurance that his case was not hopeless, and seemed eager for encouragement.

His face was flushed, the eyes were watery and bright, with small pupils, and the expression was one of extreme despondency, the forehead and cheeks being wrinkled and deeply lined. He had a feeling of tightness about the head, with occasional aching of a dull heavy character about the forehead. *The head was never comfortable.* His sleep was bad, rarely if ever having a good night, and the depression in the morning was intense. He could not read for any length of time. His memory according to his own statement was bad, but I doubted it. Such patients often complain of loss of memory when the faculty is really unimpaired. They cannot concentrate attention upon any subject, they are inattentive and as they in consequence take in no information, they cannot be said to forget it. The pulse was about sixty-eight, full, soft and prolonged; carotid and radial pulses visible, heart, lungs and other organs healthy.

He had some misgivings about losing his reason. He could not bear to be alone, whilst he was absolutely unable to share intelligently or pleasurably the resources of general society.

His tongue, the appearance of which he thought most important, was large, flabby, coated, white, and the secretions about the mouth were scant and frothy. Appetite was not good, he could eat well but without relish. Bowels confined, but often relieved by pills. He had lost flesh and strength, and was indisposed for mental and physical effort, although under the pressure of encouragement, he displayed the possession of latent energies.

Being allowed every facility for the thorough study of his case, I for some time temporized in the matter of treatment with the view of ascertaining the precise nature of the symptoms. I was soon convinced of the uselessness of drugs, and of the necessity of bleeding. This was effected by the application of a dozen leeches over the mastoid processes and temples. The relief was incredibly great. Before the leeches had been on long, the deep wrinkling of the face and forehead

disappeared, and he went into a deep sleep before a single leech had fallen. From this he was disturbed by the necessary attentions in removing the leeches, towels, etc., but he came lightly and gayly up to me in the morning with a laughing welcome, and the declaration that he had had a good night, and felt himself again. He certainly was not the same man. I, however, met his warm demonstration somewhat calmly, knowing that a speedy relapse was inevitable. So it happened, but relief was speedily secured by similar treatment. I need not detail the subsequent progress, it was rapid and culminated in a perfect recovery. Although adhering to a strict regimen during his cure, he had little medicinal treatment. His malady was always beyond the reach of drugs. Bleeding, I have no hesitation in saying, was the only means by which his cure could have been attained.

The special interest of the case lies in that fact, and it is demonstrated by his having adopted every other means within his reach, taken the best advice, stopped at no expense, and in my own experience, I found him to be the most tractable patient I ever had. He had not to be urged and driven. Nothing more was necessary than to give a clear instruction, and it would surely be carried out without any supervision.

Although a typical case, it is neither a rare nor an exceptional one. There are hundreds of such cases thoroughly incapitated from work, wretched valetudinarians, a burden and worry to their friends, accepting their dismal fate as inevitable, spending their time at health resorts, hydropathic establishments, taking sea-voyages, tantalizing themselves with pleasures they long to share, but are utterly incapable of appreciating, yet never getting well. What is the reason? It is that the nervous patient is always regarded as a feeble being, who needs rest, change, nursing, good dieting, tonics, and plenty of prescribing, or, on the other hand, his symptoms are regarded as fanciful, and requiring no treatment. He is himself averse to all so-called lowering measures, and is readily convinced that a supporting treatment is needed.

The intractable character of these cases is recognized not only by the public, but by the profession, and astonishment is expressed, not because such patients are always ailing, but that one should ever get well after several years of nerve disturbance. I never hear of any being bled, and my best friends

do not hesitate to express themselves as sceptical about the possibility of curing cases of melancholia by depletion. They ignore the physical strength often possessed by these individuals, because their brain congestion induces great lassitude which is mistaken for weakness. The weakness lies in the driving power, the Will, not in the machinery, the Body, which may be organically sound. On the other hand, let me not be understood to recommend depletion for all nervous patients, although in this work I wish to restrict myself to the consideration of what I may describe as the Congestive Type of Insomnia and Nerve Depression requiring this form of treatment. The cases require careful selection, as a reckless application of this most valuable resource to inappropriate cases will only serve to bring it into disrepute. Even in the non-congestive type, I would rarely, if ever, adopt the stimulating and overtonic measures so generally believed in. A little experience shows how few tonics suit nervous patients, and careful observation can alone lead to a good selection. No routine system can be applied. Quinine and iron usually disagree; stomachic tonics, as gentian, mineral acids, etc., do neither good nor harm; strychnine has to be given with great caution, and arsenic is perhaps the safest and most useful tonic in many cases, as Dr. Clifford Allbutt has shown.

Although many conditions might be described as having a causative relationship to this malady, they may be briefly and almost fully summed up in the term "brain-strain." It only remains to consider what forms this brain-strain assumes, in what manner and under what conditions it acts and its results.

The majority of cases begin between the ages of thirty and forty, very few under twenty-five or over fifty. This includes the most active and wearing period of life; if a man can stand the strain of this period, he will be proof against anything he may encounter afterward.

Nerve depression beyond these limits is usually of a type different from that under consideration, and is often allied to the insane condition.

It occurs in males more frequently than in females. The patients offering the most typical illustrations I have seen have been in very good circumstances, *but actively engaged*, the most constant factor in the production of this condition being continuous brain-strain.

By brain-strain, I do not mean a conscious or painful strain, but a more or less *continuous state of mental tension.* This is so constant as to be an aid in diagnosis, but the physician must judge for himself of the character of the strain, as men will always underrate their brain efforts. They will cheerfully assert that they have had nothing more than usual to do, no extra trouble or worry, but on inquiry you ascertain that although nominally spending but a limited number of hours in business, the nervous system is constantly strained during that period by the nature of the work.

Stock-exchange work is the best type of this. Many other businesses impose weighty responsibilities and constant care in their management. The director on his arrival home, does not throw off his business train of thought, he thinks of the letters he has written or which he ought to write, of his day's doings, of his morrow's engagements. To this constant strain, a little worry or anxiety may be added, such as all business men are familiar with in connection with their various undertakings, pending ventures, and all affairs whose issue is involved in a degree of uncertainty. In such situations there is brain-tension which would be recognized as anxiety did not custom deaden its acuteness. The depressed energy that supervenes is put down to liver, laziness, or the want of a little stimulant. Under the influence of dinner, etc., this condition is temporarilly recovered from, but relapses are easily induced, becoming more and more confirmed until the stage of chronic fatigue is reached, for which rest and change are prescribed, very often with the most satisfactory results.

Brain fatigue is unfortunately not so readily recognized as muscular fatigue: there is the weaker action, with greater sense of effort, but a cup of tea or a glass of wine is looked upon as the appropriate remedy. Were it a weary muscle, the owner would rest it, but being his brain he applies the spur. As long as he is awake he expects his brain never to flag or be weary.

Hence, although I lay great stress on a congestive condition of brain as an essential pathological factor in one type of case, it must be at once understood that I always regard this as secondary to tissue change of the nature of wear and tear, induced by brain effort or excitement. The congestive condition is not the primary phenomena, it is not the original cause

of the symptoms, but I believe it to be capable of perpetuating them when once established.

The subjects of this break-down or brain-strain are active, energetic, and intelligent, the sluggish and stupid are exempt. This fact accords with the origin of the symptoms from brain-strain. The active brain, like delicate and rapid moving machinery, is more prone to wear and tear. The sluggish never wears itself out.

Let us now inquire how brain-strain induces this derangement, and what is the essential pathological state underlying the symptoms.

It is a physiological fact that when any part of the body is thrown into action, there is a fluxion of blood to the part. The brain is no exception to this rule, and there is no organ so readily affected by disturbance of its circulation. The precise changes that occur in the arteries, veins, capillaries and the tissues they supply, with their mutual relationship, are most imperfectly known. Physiologists have not yet determined the condition of the circulation even during natural sleep and its relationship to the phenomena. It is vaguely described as "anæmia;" but if we ask what the anæmia means we will find ourselves very little the wiser. Of course on these points there is abundance of theory and speculation, which flourish like weeds where there is a dearth of facts.

The broad fact must, however, be admitted that as circulatory changes are associated with the various natural and healthy phases of brain activity, so in many instances may they exist as a source of morbid feeling and action. There can be no doubt that the brain is subject to acute and chronic congestion equally with other organs, and although we are so much at sea in regard to the precise pathological signification of these familiar terms their clinical application is not so difficult. Congestion, as a clinical fact, is recognized: its minute pathology awaits further elucidation.

The pathological condition of the type of nerve depression now under consideration may be described as a simple congestive condition, varying in degee and acuteness, and related to the natural physiological congestion which is the result of ordinary brain efforts. It is an exaggeration of this natural condition, an *ultra-physiological congestion*. In the healthy exercise of brain function the determination of blood to the

organ is of short duration; it produces no pain but merely exalted activity of thought or emotion. It is succeeded by a diminished fulness of vessels and a retardation of the circulation with the symptoms of weariness and exhaustion to be relieved by repose or sleep.

If the brain in this condition of weariness, the reaction of normal effort, be forced into continued action, the circulation, instead of subsiding, becomes further accelerated and we approach a morbid condition. Instead of a healthy fatigue we may get an unwholesome excitement with obvious signs in some subjects of vascular fulness (flushing and heat of head and conscious pulsation of vessels), pain or sense of fulness and tightness about the head followed by inability to sleep. It is a matter of common experience that unwonted mental exertion and excitement may cause a fluxion of blood to the brain and that sleep will not come until the heat of head and conscious throbbing are reduced. Insomnia is a constant symptom in this class of sufferers.

Such I believe to be the mode of origin of this nerve depression, which is found to occur in energetic people of good intellectual power, sound physical and healthy vascular systems; not in the phlegmatic, obtuse, and insensitive. In the latter the brain does its work more slowly; it is less prone to sudden congestion with exalted activity: they are not familiar with the excitability or the depression of the former: they do not go to extremes.

It is easy to understand how the subject of cerebral congestion may be either a sober, steady, temperate man or a *roué*. Honest labor, with none but cultured and innocent pleasures, may in one case induce that brain congestion which in another is due to over-stimulation, over-excitement and dissipation. An enthusiastic temperament usually exists in both, they are men of energy, but their energies are spent in different channels.

The brain strain I have been speaking of is certainly a usual antecedent of the more chronic cases, or of those whose onset is gradual, whose origin is obscure; but a certain proportion of cases are of an acute character, being due to worry, trouble, shock, etc. These are cases of acute brain strain. A vast number of them are met with in practice and of widely different types, varying with the temperament and constitution of

the individual; but when mental depression without delusious is associated with insomnia, I have no hesitation in saying that the main condition demanding attention in the majority is the cerebral congestion.

I quite recently treated a case of severe mental depression and insomnia of several months' duration, which yielded to treatment in twenty-four hours. It occurred in a lady who I doubt not might have been successfully treated by bromides, tonics, change of scene, etc., but it would have probably taken months to effect a cure. The brain congestion in this case was caused by trouble, acute in its onset but chronic in its duration. Misery and depression were the chief symptoms, the physical health being perfect. Immediate and permanent relief was secured by leeching. An equally satisfactory cure was effected in the following case by a few leechings, light diet and abstinence from alcohol.

Mr. H. J. consulted me in 1883. For about seven months he had suffered from severe insomnia, accompanied after a time by extreme depression. He was always strictly temperate, sound, and strong. He consulted some eminent men in London, who treated him for nerve debility, ordering tonics, generous diet (which always made him worse), rest, change, etc. One authority assured him after careful examination that there was nothing the matter with him, though he offered no explanation of the insomnia. He went to Jersey, Ventnor and Scarborough. At the latter place he met a gentleman who, having recovered under my treatment, advised him to come to Brighton. When I first saw him he had the signs of cerebral congestion pretty well marked, with the characteristic symptoms of insomnia and nerve depression. He looked over thirty, was of slight, spare build, and, putting aside his downcast, careworn features, had the aspect of health. He could not account for his insomnia, which had come on acutely. It must have originated in the ordinary brain-strain of his occupation (stock-jobbing). In addition to special medical measures to secure sleep, he resorted to various devices such as pacing his room, changing his bed and his room, reading, etc. Every symptom yielded immediately to depletion, recovery being practically immediate. I do not remember giving him any prescription for medicine. I give these two cases together, as they illustrate the simplest and most uncompli-

cated type of insomnia and nerve depression. Contrary to rule there was no relapse in either case. *Congestion must in each have been the essential pathological factor, or leeching could not have effected such immediate relief.*

I have already alluded to the unjust aspersions ignorantly cast on these cases by those who have no sympathy with low nervous states, who upbraid the sufferers with their weakness, set themselves as noble examples to imitate in the time of despair, boasting of the manner in which they treat the troubles of life. The unhappy victim of cerebral congestion is familiar with this, and hardly knows how to reply, having nothing to show as a cause or a consequence of his distress. He cannot deny that "there is nothing the matter," and reproaches himself for his weakness in not making up his mind to get well at once. But this depression is far beyond the influence of the Will, no voluntary effort can remove it, for although under the influence of cheering and lively sympathy it may be temporarily relieved, the morbid congestion is still present, and a light heart cannot be long maintained. Even physical pain of organic origin may be temporarily forgotten under excitement, but it is not cured thereby. The depression in the case described on page 550 was so profound, that it could not be relieved even for a moment by any device, although it was lost during the temporary subsidence of the congestion effected by leeching.

Acute trouble tells on all more or less, but in few does it result in this form of depression. In most cases there is the brain-strain of a continuous character already described, in others there may be nothing very definite in the way of antecedent trouble, anxiety, or strain. In such cases there is often evidence that the brain will not stand what may be called the "normal tension" of business affairs or every-day life, becoming exhausted after moderate effort. I have seen such cases attain nerve stability by reducing the work, or by a break in the day for sleep.

Some cases, however, have an acute origin, and are distinctly due to sudden trouble. These are cases of acute brain-strain. The case of J. B., described later on, is one of this group, and it conclusively proves the possibility of brain congestion being induced by trouble, and being perpetuated with the symptoms of insomnia and melancholia. The majority

of those suffering from acute trouble can console themselves by some form of distraction. Alcohol is a dangerous resource; it may induce congestion and insomnia, and it is specially perilous to a sensitive brain. Many are so constituted that they can pass through crises without excitement, through ruin without depression. Needless to say, such are not the victims of melancholia.

Although habitual intemperance does not by itself induce this condition, yet it is common to find that patients have had resource to alcohol in order to relieve their depression, a most perilous device. Many of the cases of fine intellect which have fallen victims to alcohol have undoubtedly begun in this way. Some will own to taking stimulants too freely but without any craving for them they regard them as suitable remedies, and are often advised to use them even by medical men who are led by the symptoms of despondency to conclude that tonics, full diet, and wine are needed. A temporary respite is followed by still deeper depression and habitual intemperance may supervene if proper treatment be not adopted.

It is almost an invariable rule that these cases are intolerant of alcohol, and that even a moderate amount will "fly to the head," and disturb their mental equilibrium. I have already stated that a congestive condition of brain is the essential pathological feature. If absent, the case is not such as I am describing. In these subjects it is readily induced, not only by stimulants, but by any means which in healthy individuals would induce normal cerebral fluxion. The predisposition can only be described as one of temperament, its nature, as already stated, is ultra-physiological, but this does not explain everything, and a further consideration of the symptom may throw some light on the pathology, or explain the manner in which brain-strain acts.

It is well known that the sympathetic nervous system has a large share in the control of the circulation in its normal as well as in its deranged states. A blood-vessel having a muscular coat, has a normal "tone" in health, just as a muscle has. This "tone" in the artery is represented by that condition in which the calibre is maintained, within certain limits, resisting distention on the one side, or undue contraction on the other. This tone is not a purely mechanical or physical property, but is largely dependent on the sympathetic, and if this

be lost or impaired, the resistance in the vessel is diminished. The circulation is deranged; for want of a better term we call this derangement "congestion." This so-called vaso-motor paresis or loss of sympathetic nerve influence over the vessels, is analogous to the flabby, toneless condition of muscles deprived of their nerve-supply. It may be diagnosed by the existence of visible pulsating arteries, full, yet soft and compressible. This softness of pulse is usually interpreted as lowness and weakness, and is erroneously supposed to contra-indicate bleeding or any but tonic treatment. It may, however, exist in general plethora. Bleeding is the true tonic in such a case. There is abundant experimental proof that the sympathetic has a regulating influence over the supply of blood to a part, and that it is affected in these cases is shown not only by the visible arteries, and the tendency to determination of blood to the brain, but also by the large number of symptoms referred to the abdomen, as flatulence, pain, and all manner of disordered sensation. Palpitation is also common. Withdraw the influence of the sympathetic from a part experimentally, or by disease, and there are quickly shown redness, heat, and disturbed function, but not inflammation nor degeneration. This is what we have in the brains of these patients. Their heads are sensibly hot; there is visible flushing of superficial vessels, and the brain functions are disturbed. The man who complains that he cannot think, is really never doing anything else; he cannot stop thinking. The brain will not take its rest. Its action is uncontrolled through loss of the brake-power vested in the sympathetic. Its condition resembles that of a mill broken loose in a storm, whose activity whilst unarrested is spent upon itself, in wear and tear that may end in wreck and ruin. So also with the brain. Its ceaseless action is worse than wasteful, it is destructive of its own tissue, generating excessive heat, perverted thought with unnatural mental condition and feeling. A patient in answer to my inquiry about his sleep said: "My body sleeps but my mind never does." I do not know that a better description could be given of the slumber, rendered half conscious by vivid dreams, that fails to rest or refresh the mind. If brain strain be the essential cause of this condition, why, it may be asked, should such importance be attached to the sympathetic derangement?

The relationship between the brain and sympathetic is the

closest possible, it is one of mutual dependence. The brain, roused to action, makes the demand; the sympathetic responds and regulates the supply. By too prolonged brain action the sympathetic influence is deranged by over-excitation, exhaustion supervenes, which results in loss of vascular tone. The first and wholesome sign of brain fatigue is anæmia, indicated by pallor, with a not unpleasant feeling of weariness or drowsiness. The sign of chronic fatigue is congestion, indicated by redness, with irritability, restlessness, and insomnia.

There are, however, certain cases which have an apparently visceral origin. In such, how is brain strain produced? Visceral disturbance may exist to a large extent without mental depression, nor will this be induced as long as the irritation is limited to the abdominal sympathetic. When the subjective feelings, aroused by such derangement, predominate, so as to interfere with ordinary thought, a morbid self-consciousness is induced, involuntary brain action follows, and the usual symptoms of brain strain are developed. This morbid self-consciousness is specially liable to occur in functional derangements of the sexual organs. If, for instance, a man becomes melancholic on finding himself impotent, the essential cause is brain shock, and the sympathetic derangement of his viscera is only a remote cause. Until the impotence was recognized, the sympathetic disturbance was limited to the abdomen; the sudden discovery produces an emotional shock, which determines cerebral congestion. Such a case might be described as of visceral origin, but it would be more correctly classed as one of acute brain strain. The action of the sympathetic on the vessels is inhibited, cerebral fluxion follows, and may persist, as already explained in the description of hyperphysiological congestion. In such a case the treatment should be directed to the brain congestion, preliminary to any attempt to cure the impotence. The reverse method of stimulating the generative organs by aphrodisiacs is often mischievous.

That all abdominal functions can be influenced by brain conditions is a matter of daily experience. The tongue cleaving to the roof of the mouth in sudden shock, the anorexia, intestinal disturbance, etc., in anxiety are marked instances, but they show how close is the connection between the head and abdomen, all these phenomena being dependent on the association of the brain and sympathetic nervous system. Hence

it would be absurd to deny that the deranging influence may start from either end of the nerve circuit. Visceral derangement may, in my opinion, produce profound mental effects by reflex action, but to regard abdominal visceral derangements as the primary and continuous cause of this form of congestive neurasthenia, is but rarely true. In investigating these cases I carefully search for visceral disorder, and the clue to successful treatment may there be found, as in the cases referred to subsequently, where the subjective feelings of an obscure visceral lesion induced this form of chronic brain strain.

Hence, these cases may be broadly classified as acute and chronic brain strain. In the chronic case the normal physiological congestion following ordinary brain effort is prolonged and exaggerated, when it may be described as ultra-physiological. When thus established, it may be maintained for months or years with no appreciable subsidence, causing involuntary cerebration, as seen in the constant brooding by day and night, with light, dreamy, unrefreshing sleep. Congestion, I again repeat, is not the only factor, but it is an essential characteristic. If it be absent, the case does not belong to the type I am now describing. Many cases are met with presenting many symptoms in common with this type, but of entirely different nature. They may be anæmic. With such I am not now concerned, and neither the present description nor the treatment I specially call attention to, is intended to apply to them.

The acute cases only differ from the chronic in their origin from sudden shock or brain strain. They are conparatively rare.

Many maintain the essential feature of these cases to be simple "wear and tear," and on this too narrow view base their treatment by full diet, tonics, nervine stimulants, etc.—the utter uselessness of which is so commonly recorded by these patients. I am reluctant to admit that there is any waste of nerve tissue not compensated by repair. I consider the more probable sequence of events to be, firstly, brain strain with normal waste and repair; secondly, the normal physiological congestion prolonged by effort, excitement, or habit; finally, ultra-physiological brain congestion with active waste and *repair.*

The problem is to restrain the active waste of nerve energy, to control the function; not to stimulate nutritive processess. The engine does not want feeding: it wants the brake power restored. This done the patient will recover without the aid of phosphorus, cod-liver oil, wine, etc., of which as a rule he is most intolerant.

If the waste were excessive and not compensated by repair, immediate relief, so common a result of the treatment by depletion, could never be obtained. On the other hand, it is easy to understand this on the theory of congestion. The over-distended vessels are visibly relieved, the aspect of the patient is changed, the brain is freed from irritation of an over-active circulation, sleep follows, and involuntary cerebration ceases.

The earliest symptoms of this condition are those of slight nerve exhaustion and depression, most marked in the morning. Even after a fair night's sleep the mind is clouded, the body weary, and there is a want of that light, vigorous, refreshed feeling that should be experienced after sleep. Patients say their sleep seems to do them no good. There is no inclination to rise, and the day's work is looked forward to with a heavy heart. Needless to say how many are familiar with these symptoms in greater or less degree. They are often transient, experienced during a period of anxiety, and lost when the crisis is over, calling for no active treatment. The morbid case is that in which there is no evident cause. In the midst of active work, usually quite congenial, there arises a feeling of apathy, dulness, incapacity, and oppression, an undue sense of effort, however trivial the task that demands attention, and an exaggerated self-consciousness. The organs of an individual in health do their work unattended by any morbid sensations, but when they discharge their functions badly they become the seat of discomfort, not always of pain; in some cases because the organs are not sensitive, and subacute or chronic congestions being gradually acquired, and only one stage removed from the normal condition, do not produce any violent irritation. Although an inflammation is invariably attended or preceded by a congestion, this may frequently exist without inflammation, and there is no better illustration of this truth than the cases now under consideration in which inflammation never occurs although the congestion may persist for years. Although there may be but little pain, there

is a never-failing uncomfortable feeling about the head, variously described as tightness, numbness, fulness. Although these characters may be more intense in one part than another, *there is no strict localization.* The head is uncomfortable everywhere, although it is usually worst across the upper part of the forehead from temple to temple, in some cases it is worst at the back; it is never unilateral.

In marked cases there is throbbing, especially after stimulants or meals. In this general diffusion of discomfort it contrasts with the localized character of neuralgic head affections. There is a feeling of heat obvious to the hand applied to the head. Many have great difficulty in describing the peculiar abnormal feelings about the head.

Vertigo may occur on stooping, excitement, on exertion or in some cases without any evident exciting cause.

Undue self-consciousness is associated with a corresponding difficulty in concentrating the attention in other channels. Hence, loss of memory is complained of, and patients will even say that their faculties are failing them, although, I am sure in these cases the intellectual powers exist unimpaired. They do not think clearly on subjects because their attention is abstracted by self-consciousness. There is involuntary cerebration. The mind becomes possessed of ideas relating to self. Each patient believes that *no one suffers like himself* and *that he will never be himself again.*

In a mild case the self-consciousness may be suppressed by the diversion of outward things, but in a severe case, such as that described on p. 550, nothing can interrupt it, and then there is utter incapacity for the conduct of business affairs. The intellectual powers are masked but not lost even in the worst case, thus differing from the melancholia of the insane, where there is a radical mental derangement. The question of sanity is raised in severe cases, and the sufferer is often depressed by the fear that his mind is giving way and that he is on the high road to an asylum. This fear is happily groundless, for these cases, although possessed by a constant sense of misery and all kinds of unnatural feelings, *have no real delusions.* They may utter absurdities in a half-serious tone, profess apprehensions of poverty, asserting that they will die in the workhouse, etc., but they never think that their means are exhausted or that they are already ruined, and if there be

anything unreasonable in their ideas they can be convinced by reasoning, but in the insane melancholic the delusion is usually a mental fixture, arguments and assurances being of no avail.

The subjective feelings of these patients are real, not imaginary, nor misrepresented, nor exaggerated, as is so often assumed. They are as genuine as the subjective feelings of any organic disease. There is nothing unnatural nor unintelligible in their symptoms. A congestion in the brain induces pain and disordered function (misery and insomnia) just as a gastric congestion induces pain and indigestion. The unfortunate, who suffers from brain congestion, is put down as a nervous man, and is told to imagine there is nothing the matter with him. His symptoms are, however, real; not fanciful; he is melancholic, but is neither hysterical nor insane. All perversions of feeling are recognized and regretted; he worries that he is getting so mean that he hates to spend a shilling; that his taste for music, reading, or any other hobby is lost; that his affection for his friends, his horses or dogs is not as it was. In spite of all his perverted feeling, he is a rational man, perhaps more so than they who try to reason him out of his condition, by arguing the unreasonableness of his feeling, the very thing of which he is already consciously convinced.

Some have a feeling as though something dreadful were about to happen to them; they avow their lives are not worth living, and wish themselves dead. Suicidal ideas are entertained, but rather in the way of dreading such a terrible issue than of taking steps to carry it out. I believe such cases never commit suicide; despite their misery they cling to life: they fear death rather than court it.

One common feature of the self-consciousness resulting from brain congestion is the eagerness with which the patient will talk of himself. This is the subject of which he never wearies, sometimes as in the case described on page 550, the only one on which he can converse. He will return to it again and again with the same person, feeding his hopes on the same assurances, and consoling himself with the same sympathies. I am now speaking of advanced cases, though it is not an uncommon feature in the early stage; and at the *table d'hôte*, promenade, or wherever a listener of five minutes' acquaintance be found, he reveals the morbid symptoms for which he is

seeking rest and change. Hence, the unjust and uncharitable opinions that are expressed of such cases, that they are weak minded, that their ailment is imaginary, and that there is nothing the matter with them but nervousness.

The most important and characteristic symptoms are nerve depression and sleeplessness. The depression in mild cases may be slight, and only felt in the morning, passing off after the excitement of work or the stimulus of suitable food. It should be noticed that it is greatest in a state of inactivity. It is not aggravated by moderate exertion, and may be temporarily relieved thereby. In this respect it contrasts with the depression of certain cases of nerve and physical exhaustion from overwork, which is relieved by rest, and induced by exertion. Such cases require supporting diet, tonics, and brain rest.

The depression may be so profound as to be reflected in the features, which become wrinkled, careworn and downcast, combining the lines of age with the florid aspect of youth. While, however, the wrinkles of age are due to wasting of fat and intermuscular tissue, and are irremovable, these are due to the contraction of the muscles of expression, dependent on brain irritation, and are curable. In proof of this, I refer to the first case I leeched, where after a free flow of blood and consequent relief of brain congestion, the muscles of the face relaxed, the skin became smooth, and the whole expression changed. I have observed this in many other cases, but never in a more marked manner than in this case.

As the depression is usually of gradual development, rarely attaining its full intensity acutely, it is easy to understand that in the early stage it is slight and may be overcome by effort. A real source of worry intensifies it rapidly. The patient loses all interest in his surroundings, and everything is undertaken with reluctance, and a great sense of effort. The advice is often given to take wine, full diet, seek exciting recreation, but in cases of the congestive type the symptoms are thereby aggravated. Health resorts are frequented with little or no benefit. Every effort to remove the melancholy by exciting pastimes is fruitless. I have known many who were most favorable situated for the enjoyment of healthy pursuits, as hunting, lawn tennis, society, public entertainments, but few are cured by such means. They may be useful

as adjuncts in treatment when carefully selected, and used in combination with other means.

The depression may be partly due to want of sleep, but not entirely or mainly so, for neither natural sleep nor the use of sedatives removes it, while I have often seen it removed by depletion. Some patients have an instinctive feeling of some relationship between them, as they often say, "if I could sleep I'm sure I'd feel better." Moreover, depression often precedes the insomnia by a distinct interval. A favorite attitude is sitting down leaning forward with the elbows on the knees, and biting the finger nails. I have known this alleged as a sign of insanity on good authority, but many who have no experience of melancholia indulge in this habit. A predisposition to nerve disturbance may often be found in such cases.

Though self-absorbed, thinking of none but himself, he should not be described as a selfish being. He sees the whole world happy, and he cannot witness the cheerful scenes to which he is advised to resort, without lamenting that condition which converts him into an isolated miserable unit. Hence, he is liable to be impatient and irritable in temper. Insufficient sleep is one of the most constant phenomena. In the earlier stages, and in mild cases it is of course not unusual to have a good night, but in severe cases it is very exceptional to have a long sound sleep. Many sleep the early part of the night, waking in two or three hours with an unrefreshed but "wide awake" feeling, and for the rest of the night only light snatches of sleep are secured. The night restlessness is in some cases so severe that the sufferers are unable to remain in bed, and may even wander about for hours as in the case of J. B., p. 586. Suicidal tendencies are naturally suspected, and great anxiety is experienced during these night wanderings.

The sleep of some is so occupied by vivid and often horrible dreams, that they have the conviction in the morning that they have hardly closed their eyes all night. Hence, an unconscious exaggeration in the accounts of some patients.

All sorts of devices are resorted to to procure sleep, such as walking about the room, getting into another bed, eating, reading, etc.

When cerebral congestion occurs at the climacteric without brain irritability, the sleep may be profound but unrefreshing. This illustrates another clinical type, and is often

associated with numbness in the arms or legs, drowsiness, lethargy and general depression in otherwise physically sound constitutions.

The eyes usually look small on account of a slight approximation of the lids due to the wrinkling of the forehead and face. There is some intolerance of light, but not so marked as to be specially complained of. The eyes have a bright, watery, glistening appearance, and in some the vessels are seen large and distended. The lining of the lid is very red; the pupils are small. Vision is often hazy, or an appearance as of a misty veil in front of the eye often occurs. Aching and fulness of the eyeball are often felt. The eye is easily fatigued by reading, the letters appear to run into one another, and the head symptoms are aggravated.

The hearing is acute, often over-sensitive, rendering the patient intolerant of sound. Singing and other noises in the ears are often complained of. The subjects of this form of nerve depression are, as has already been stated, well nourished, not often fat, but muscular, wiry, of robust build, good family history, and are usually able to assert that their lives have been free from illness. They eat quickly but without much appreciation of the pleasures of the palate. They say their digestion is bad, their stomach and liver out of order, and that their food does them no good. Liver and stomach are blamed for all, and as the medical treatment is often based on this view with a certain amount of benefit, it is difficult to convince such a patient that his liver is not primarily at fault. It is true the tongue is usually whitish, the patient insists that it is brown at the back, even if it be clean in front; it may be large, the salivary secretions may be scant, the mouth may be clammy, and all these symptoms may be worse in the morning, yet in spite of the temporary relief afforded by blue pill and black draught, this digestive disturbance is only secondary to the nerve disturbance, and does not deserve the prominence assigned to it. Digestive derangement due to nervous states is an every-day experience. A sudden shock will dry the mouth by arresting secretion, impede swallowing and destroy all inclination for food. The acute and often profound gastric symptoms occurring during migraine are by many considered secondary to cerebral disorder.

New patients take more medicine, though as a matter of

fact, few require less. The liver disturbance is but an offshoot, the root of the mischief lies in the nervous system.

As impotence and other sexual derangements often co-exist with melancholia and insomnia, the advertising quacks, by exaggerating the importance of these symptoms, rouse the fears and plunder the pockets of their victims, and as masturbation may at some time or another have been practised they dwell upon it as the root of the evil, and intensify the mental distress of the patient who would quickly escape from such terrorism if he were not assured of a cure by secret and expensive remedies.

Impotence is in these cases usually secondary to the nerve depression, but it is too often regarded as the main symptom, all the treatment being directed to its removal, on the view that if successful the patient will in every other respect be made sound. There certainly are cases in which impotence is a primary symptom and nervous depression usually co-exists. I have known acute and profound depression supervene in a man on finding himself impotent, but I am not at present concerned with these cases, but with those in which the impotence is secondary. The melancholy is intensified by consciousness of sexual debility, just as in some cases it may be induced by it. In fact, the impotence and melancholy react, each aggravating the other.

There is a great proneness to mental depression in other affections of the generative organs, both in men and women. I have just been consulted by a gentleman whose melancholy supervened on an attack of gonorrhœa two years ago which was incompletely cured, a gleet remaining for a year. He had consulted several doctors, who treated him either for stomach derangement or nerve debility, but disregarded the local trouble. As treatment was never followed by material improvement he came to me convinced that his impotence and misery had some local origin, and that as his previous advisers ignored it, the failure of their treatment was thereby explained. I expected to find him free from any local disease, but on examination a gleety discharge was detected. The anxiety and worry of this intractable malady had undoubtedly induced the melancholia. The diagnosis of "nothing the matter" was here erroneous, and he was unjustly accused of harboring a delusion. The case is interesting in having a very

obvious local lesion associated with the depression: it was, so to speak, a rational depression. It illustrates the importance of thoroughly investigating these cases so as not to overlook organic disease. When nervous men give their peculiar accounts of morbid feelings which do not correspond with any special malady, it is common to diagnose nerve debility, which in their estimation often means nothing; and no attempt is made to find any pathological condition to explain the symptoms. I grant it is the exception to find any organic disease, but it is sufficiently common to warrant the greatest caution in the search for it. A gentleman recently consulted me for nerve depression associated with vague abdominal symptoms, pain, flatulence, dread of food, etc., his adviser, an eminent London consultant, had treated him for nerve debility and indigestion. His real trouble was a fæcal accumulation in his cæcum.

A parallel series of cases exists in women, who, with nerve symptoms but without objective signs, are classed as "hysterical." When I was a student the diagnosis of hysteria was very frequent. Many of the cases I am now describing would have been called "hysteria in men." Personally I own to finding cases of genuine hysteria so exceedingly rare that long periods may pass without my meeting one, although neuroses of the most distressing character are constantly met with. I have already referred to many cases being diagnosed as hysteria, while serious disease was overlooked. Such mistakes will become less frequent as the means of physical investigation and clinical research improve, but there remains this class of men who for want of rational treatment suffer from year to year, their ailments being regarded as imaginary, requiring moral suasion only.

Another rash assumption commonly made against these cases is that masturbation has originated them. When nerve symptoms, arise from this cause melancholia in my opinion is not the chief feature, nor is insomnia. Anæmia is often present, but the cases I am considering are never anæmic. Moreover, the depression associated with masturbation often occurs early in life, is not preceded by brain strain, is often characterized by impairment of intellectual power, and may be closely related to the insane condition. In fact, lunatics do so commonly masturbate that masturbation is held by many to be a potent factor in the production of insanity.

I have already stated that these cases have a previous history of good physical and mental health, that they are not anæmic, and I must now add as another important negative feature, that they are not neuralgic. The vascular condition is most characteristic of the type now under consideration, and as it is an influential consideration in determining treatment its importance cannot be exaggerated.

The skin of the face and neck is usually ruddy, in marked cases the arteries of the neck pulsate visibly, especially after food or stimulants, the pulse also is visible, the veins are full and in some cases feel as tense and round as the arteries.

Turgid skin, bright red mucous membrane, visibly pulsating arteries and full tense veins, associated with insomnia and melancholia without delusions, sufficiently define a certain class of sufferers, but there are many others of the same character whose vascular condition is not so typical. In some the signs appear conspicuously in the head and neck, but there is no marked congestion elsewhere. In the first class there is a general plethora of blood; in the second there is fluxion of blood to the brain only, a local pletheora.

The case on p. 557 may be referred to as illustrating this fluxion of blood to the brain where there was no excess in the body. Although *these cases* are never anæmic I do not wish to assert that cerebral congestion never occurs in anæmia. Structural disease of brain and many conditions affecting other parts of the system may induce it even in general anæmia, but in the type of insomnia and melancholia I am now considering, there is no organic disease, nor fever, nor inflammation. Indeed it would seem that the congestion is the sole morbid condition in a large number of cases if we may judge from the immediate and permanent improvement effected by depletion.

The head is sensibly hotter than it should be. The patient is conscious of this increased heat, and it is usually attended with abnormal subjective feelings in the head. These feelings patients often describe with difficulty. They complain of discomfort, not always amounting to pain, tenderness, fulness, tightness, contraction, occasional throbbing experienced more or less all over the head, but usually worst in the forehead. The feelings are not strictly localized nor are they ever unilateral. In very acute forms the headache may be madden-

ing, as in case on p. 577, when it has the same features as the congestion which precedes brain inflammation, and is attended by a bursting pain in the eye-balls, intolerance of sound and light, muscæ volitantes, etc. There is no such intensity of symptoms in the chronic cases, although at times the headache may be severe.

A special feature is the *constancy* of the discomfort in the absence of treatment. "My head never feels right" is a common statement. This constancy is characteristic of other clinical features of these cases and is of diagnostic value. It distinguishes them from the hypochondriac, who first imagines he has cancer of the stomach, then stone in his bladder, and as soon as he is persuaded of his error has another disease to be disposed of at the next consultation.

It may be taken as a rule in practice that where a symptom is constant a definite pathological condition underlies it. To describe symptoms as "nervous," is, as applied to these cases, the equivalent of saying that they are fanciful or fictitious. In opposition to this I maintain, that constancy in a sane patient is a test of reality, and such constancy is characteristic of the cases I now describe. If any delusion exist as to the genuineness of the symptoms it is the doctor's, not the patient's.

Any excitement, mental effort, the use of alcohol or even an ordinary meal may aggravate the head symptoms, notably the heat and pain. They are usually worse in the early morning or in the recumbent position, better in the cool air with the head uncovered.

In typical cases the intolerance of alcohol is marked, a single glass of wine producing fulness and heat of head. In some cases this tolerance has been observed before the onset of depression, the patient remarking "I never could take wine, it always went to my head."

With this tendency to congestion of the head there is often associated a coldness of the extremities. This is a very constant symptom when depression has supervened, and is in many cases a valuable index as to the general state of the patient, the effect of remedies, etc. Artificial warming of the extremities has but little effect in cooling the head, but again and again have I seen the relief of general depression proportionate to the perfection of the natural circulation in the feet.

"Head cool, feet warm, and bowels open, you may laugh at physicians" is a good and true saying. These sufferers have hot heads, cold feet, and confined bowels. They are usually acquainted with many physicians.

Giddiness is present to a variable extent; in some cases only on stooping or exertion, but in others so badly that the patient is afraid to walk along unless he is close to railings or some support. I never knew any one fall or faint with it, nor do I think this a probable result. It comes on at irregular times, with very little warning, and when severe is alarming to the sufferer, who fears he is going to have a fit. A mist, haze or "cobweb" appearance before the eye is usually associated with it. It is like the vertigo which often precedes an apoplectic attack, and is dependent on the congested condition of the vessels of the brain. It is one of the indications for bleeding, by which it may be permanently removed. It is often erroneously interpreted as a sign of weakness or want of blood; and tonics, stimulants, etc., are resorted to instead of salines, aperients, and bleeding as in the case referred to on p. 589. Such patients do not become pale with their vertigo, and present no signs of faintness beyond an acceleration of pulse.

With this peculiar combination of mental irritability and depression, of over activity and unproductiveness, there may be a restlessness which in some cases is so great that the patient cannot without great effort keep long in one place and position, nor fix his attention on any subject, whether a topic of conversation or reading, nor persevere in any work. All sedentary work is intolerable, the impulse to rush out of a house, to abandon work and wander aimlessly away is often irresistible. Nothing proves the absence of physical debility more than the severe and sustained exertion they impose on themselves under the influence of this restlessness which they thus seek to relieve. Some spend hours in night wandering, unable to stay at home in bed, where they find neither rest nor sleep. In milder cases the restlessness at night may be relieved by some milder device, as sitting up for a time, reading, walking about the room, changing the bed, etc.

No wonder that though they may eat well they gain no flesh, but on the contrary they grow thin. This, however, is not a serious symptom, as the loss of flesh is not great. Some

assert that they lose strength, but in these cases it will usually be found that the loss is apparent, not real. The will for exertion is lost, there is no inclination to move or do anything with a purpose; the physical power lies dormant, as the driving power, the Will, is out of gear.

This fact is proved in those cases where after leeching, strength is at once regained, although previously great weakness was felt; showing conclusively that the strength must have been there although dormant, as it could not be generated *de novo* by bleeding, although the will power may have thereby been set free.

Signs of digestive disturbance are in many cases so prominent as to lead to the opinion that they are the *fons et origo mali.* The patient is prone to believe that his liver and stomach alone are at fault, because the depression and other nerve symptoms are closely associated with abnormal feelings referred to the abdomen. The term "hypochondria," signifying "under the ribs," shows an ancient recognition of the connection between brain and stomach. The tongue is usually disordered; it is often large and flabby, marked by the teeth, especially in chronic cases; it is more or less coated. The secretions of the mouth are scanty.

Flatulent distention of stomach is common, often producing great abdominal pain. J. B.'s case, p. 586, is the most marked illustration of this I ever met with. He was distressed by large volumes of flatulence, which caused violent and irresistible belching attacking him often while taking food. This flatulence causes palpitation and other distressing feelings about the heart.

Nausea, acidity and burning sensation about the stomach may be felt, though not so constantly as the flatulence. Food is taken well enough, but without relish, and there is great tendency to "bolt" everything. After meals the discomfort of head and stomach is usually increased.

The bowels are usually confined, but these patients soon acquire the habit of taking aperient medicines, having an instinctive dread of constipation, which they believe to have some connection with their worst attacks of depression. There are no symptoms on which they expatiate so much as the state of the tongue and bowels, and experience teaches them that a certain amount of relief is got by free purgation. The

tongue is with them the index of health. How natural, therefore, for them to concentrate their attention on so important and accessible a point of observation.

Finally, I must again draw attention to a point I cannot too strongly insist on, that though the symptoms may be cerebral or gastric, the condition of the circulation is the special and distinctive feature of the type of nerve cases I am now considering. It is the condition which is most amenable to treatment, its relief is often followed by recovery without the use of medicine, and where the result falls short of this, other treatment will be found to act which had previously been inert. The congestion of the nerve centres may be part of a general plethora, or the fluxion of the blood may be restricted to the head, the superficial vessels not being distended. Anæmia is never present, not even in an allied class characterized by nerve depression with very low arterial tension. There is no difficulty in recognizing this as an asthenic type unsuited for treatment by depletion. In this type the symptoms are not so constant nor so prominently centred in the head, there being no special heat of head; sleep may be good and intermission of symptoms occasionally occurs.

It may be asked why have I not described these cases as neurasthenia. The answer is that the term neurasthenia conveys no definite information, and is applied to totally different types of disease. The Weir Mitchell treatment, for instance, is applied to one type described by Dr. Playfair as "characterized by anæmia, anorexia, very slight consumption of food, emaciation, often extreme, great physical weakness, and most frequent in women." Again, "typical cases are old-standing bed-ridden and wasted invalids, or the hysterical cases who are dependent on the sympathy and attention of their friends." In every feature this is the reverse of the type I describe, and the treatment is the very opposite, although both may be placed under the head of neurasthenia. The term is useful as implying a large and heterogeneous group of cases characterized by functional nerve disturbance, but this is only the beginning of classification, and as the different types present so many features in common, it is difficult to subdivide so that each group shall include only its own type. To speak of a sthenic neurasthenia sounds paradoxical, yet it is true as applied to the special class I am describing. The most generally applic-

able term descriptive of this type is "congestive neurasthenia." This term indicates the prominent symptoms of nerve debility, and the characteristic signs of cerebral congestion with which they are associated. I think the essential type is thus defined, although great variety will be observed in the features of individual cases more or less dependent on natural temperament and disposition, age, mental occupation, general habits, acuteness of attack, whether associated with local fluxion of blood or a general plethora, etc.

The treatment of the typical cases of this class of disease is indicated by the characteristic clinical features. These suggest reducing measures, but as a matter of fact, tonics are usually prescribed.

Iron determines to the head, deranges the liver, and aggravates the symptoms; quinine fails to relieve and is rarely an appropriate remedy; strychnine may improve to a small extent but is not curative, nor are arsenic, phosphorus or other nervine tonics more reliable. Sedatives are largely used, especially chloral and bromides. Hardly a single case escapes a dosing with the bromide of potassium. Opium does not relieve the brain congestion nor remove the depression. To avoid any accusation of the indiscriminate adoption of a routine treatment in all cases of nerve depression, I cannot too frequently repeat that I am at present considering but one class who, in spite of their misery, are characterized not by want of nerve, for they are too full of it; they are of the neuro-sanguineous temperament, not naturally indolent or phlegmatic, but active and energetic, never anæmic, usually males of mature age. Nervous symptoms with depression exhibit many other types, requiring a different treatment, often tonic and stimulating. My present object is to draw attention to the fact which I have proved again and again in my own practice that there are many cases of nerve depression which can only be successfully treated by bleeding, saline aperients, low diet, and no stimulants, though they are usually treated by directly opposite remedies. The description already given will serve to identify the cases with precision, and distinguish them from allied types. The absence of anæmia and neuralgia, the presence of melancholia without delusions in healthy people, insomnia, suffusion of face, neck and conjunctivæ, vertigo and other abnormal feelings about

the head, visible arteries and full veins with intolerance of stimulants and iron tonics fairly characterize the type. Many are as intolerant of chloral and opium as of iron and stimulants. Instead of soothing and producing sleep, they may excite and provoke the greatest distress, especially where the signs of brain congestion are prominent, viz., heat of head with throbbing vessels, abnormal feelings *all over* the head, as aching, tightness, fulness, pressure, bursting, etc. Such symptoms may arise acutely in connection with other disturbances of the system, and as the same treatment is applicable for their relief, I will quote a case to illustrate the clinical features.

A very healthy woman, æt. 35, mother of several children, was attacked about a week after her confinement with fulness about the head, insomnia, and great depression. Her medical attendant, attributing the symptoms to lowness and weakness, ordered port wine and a supporting treatment. In a very short time all the symptoms were aggravated, every object she saw appeared to be blood-red, inflammation of brain was diagnosed, and she passed through a critical illness of about two months.

Some years afterward I attended this same patient in a miscarriage, a few days after which she was attacked with fulness, aching and heat of head with profound depression. The headache she described as unbearable and she anticipated an illness similar to that above mentioned, as the premonitory symptoms were identical. I applied leeches to the back of the ears and temples, relief was speedily obtained, she had a comfortable night, felt well in the morning and made a rapid recovery.

Very few would allow that bleeding is permissible after a miscarriage or labor, and I admit this is the only time I have adopted it under such conditions. Experience teaches the folly of being blindly led by rigid rules of practice. Some say never bleed or adopt any lowering measure in cases of mental depression; never allow beer or beef in albuminuria or a crumb of bread when sugar is in the urine; never allow anything but milk to infants; if we practise on such inflexible lines our patients may perish by our prohibitions.

But to our point. This case has been again leeched under circumstances contra-indicating any lowering measures if it were possible to avoid them. Five years have elapsed since the above illness. For the last two she has had frequent

passage of gravel and an intractable diarrhœa, profuse and watery, the so-called nervous diarrhœa. She had no gout. The appetite was so bad that the luxuries of diet or the plainest elements were equally repulsive to her, and she consequently got much below par, and the symptoms of disease of the apex of the left lung developed, tending to consumption. She was about 43 years old, had been quite regular till about ten days ago, when the period came on, but ceased in a day, leaving a violent headache which confined her to her room. The usual remedies gave little or no relief, and at the end of a week I received an urgent message in the night to see her. I found her in the greatest distress and prostrated by a headache which she described as agonizing and unbearable, being of a full, hot, bursting character, with intolerance of light and sound. The pain affected the whole of the head which was very hot, and radiated to the nerves of the eyebrows and face. Although, for reasons above described, I was reluctant to bleed, the intensity of her distress, the failure of previous measures, and her urgent appeal for speedy relief gave me no alternative. Leeches were applied behind the ears with marked effect. The fulness and heat of head were relieved, but a violent neuralgia of the fifth nerve appeared. The neuralgia almost certainly existed at the time of the leeching but was masked by the general congestion of the brain and indistinguishable from it. The congestion was cured by the leeching; the neuralgia was revealed, but not produced, by it. It gradually subsided and in a few days was lost. This case illustrates congestion as a symptom and its direct treatment independently of any malady with which it may be associated; but in the nerve cases I am now considering it is more than a mere symptom; it is the pathology of the malady, and in some cases apparently the sole morbid condition on which every symptom depends, for on its removal by bleeding I have seen an immediate return to health.

Cerebral congestion, whether an accidental complication of some other disease in the system, as cerebral tumor, delirium tremens, etc., or forming an integral part of the malady, as I believe it to be in certain forms of nerve depression, produces essentially the same signs, varying in acuteness but not in nature. In very acute cases pain may be intense and the congestion resemble the inflammatory type. Indeed, the case

above described was considered in the first attack to be inflammatory, but the absence of delirium, coma, double vision or any form of paralysis renders that diagnosis more than doubtful. The chronic cases require a treatment similar to the acute; in both classes most drugs are useless, while leeching is markedly beneficial under the indications given.

Bleeding in any form is now so neglected by the profession and in such ill favor with the public that some assurance may be needed as to its harmless character. In these nerve cases when indicated the first thing necessary is to assure the patient that the remedy is incapable of harm if properly managed. Even where no benefit has been derived I have never known any harm result. I have leeched in one case over the eightieth year, giving complete relief to urgent symptoms of pain and heat of head, hazy vision, vertigo and pain in the back —symptoms not uncommonly associated in healthy people at advanced ages. An old time-keeper the Brighton Railway Company had similar symptoms removed by leeching when about 70 years old. I am at present attending a gentleman in his eightieth year who for the last year has lost large quantities of blood from the bladder, and recently the loss has been so profuse as to blanch him, yet it has not imperilled his life, and after a night of pain and hemorrhage his morning pulse was only 70. Certainly he is a wonderful exception, but I have no hesitation in saying that a moderate hemorrhage at an advanced age is often of the greatest service in relieving vascular tension and prolonging life. Vascular tension after middle life is a serious condition and is often the weapon by which the last fatal stroke is inflicted. Loss of blood in operations after accidents, and from disease, is easily made up if once the flow be stopped. Bleeding does not directly produce disease; so long as there is enough blood to nourish the brain and heart the other organs may discharge their functions perfectly. Wounds often heal well and patients rapidly recover after they have nearly bled to death. Recognizing these facts what ground of alarm is there in the hemorrhage carefully induced under medical supervision? There are many whose lives would be rendered longer and more secure by the occasional bleedings to which their forefathers were accustomed. I do not advocate a return to the general and indiscriminate use of the lancet which characterized a past era and ended in

a reaction which led to the complete neglect of a most valuable resource in the treatment of certain conditions of system; I merely advise its moderate use in specially selected cases, but believe that its application is capable of vast extension, and that in the medicine of the early future the indications and methods of bleeding will be defined with an exactness in accordance with our modern systems of therapeutic investigation and clinical record. A theoretical objection may be raised that the volume of blood is so rapidly recovered by absorption that bleeding can effect no permanent improvement. This may apply where vascular tension is normal, but where high tension is reduced by bleeding I have again and again found a permanent impression made on the pulse as though absorption stopped at the normal instead of restoring the old state of tension and congestion.

A careful investigation of the clinical features of a case will be the foundation of the opinion as to the suitability of bleeding, but this may be confirmed by certain lines of treatment. If symptoms, especially of head, be aggravated by stimulants or iron tonics, but if light diet with blue pill at night and some saline laxative in the moring relieve, the assumption is safe that bleeding, which will act in the same direction, will be beneficial. Most of the cases coming under my care undergo a preliminary investigation of this kind unless the indications for bleeding are very obvious.

The assertion that nerve depression may be cured by bleeding is received with scepticism in some critics amounting to unbelief, but with the knowledge and conviction in my own mind of its absolute necessity in the treatment of some cases I am impelled to publish my views, which a larger personal experience and a more general testing must confirm or modify. An instance is quoted on p. 589, in which an eminent physician sharply criticised the very moderate depletion to which the patient was subjected. As another instance showing prejudice against such treatment I recall a discussion on melancholia in which I stated the good results obtained in selected cases from bleeding. I asked the opinion of an authority present, who disdained to recognize any possible service from such treatment, although he had had no experience of it.

Happening for the first time to see Dr. Savage's new work on Insanity I took it up and opened on the following case,

showing the relief of insomnia by leeching. It is under the heading of "Brain Hypochondriasis," and is related in the patient's own words: "I am a medical man and my age is 47. I always had a very good constitution and possessed great muscular strength, active habits and an excitable temperament. One morning in March, 1879, being at the time in perfect health, I was tempted to commit self-abuse. I had done it before, but not very frequently, having foolishly abstained from marriage. I was immediately afterward seized with giddiness. While dressing before the looking glass I noticed that my face was flushed in a manner I had never before seen, being livid and congested and of a dark purple hue. My pupils were also exceedingly dilated at the time. On that day I felt my gait tottering and my temper disposed to be irritable. That night I had very little sleep and suffered severe pain in my head. From that time sleep departed more and more. I resorted successively to every known narcotic drug, gradually increasing the doses, until I gave them up as inert. I went away to mountain scenes to try change and exercise, but no benefit accrued. I returned and made a desperate struggle to carry on my practice, but finding myself becoming worse I went to the Hydropathic hospital in Yorkshire and underwent the treatment there without any good result. I then transferred myself to the Leeds Infirmary and was under Dr. Clifford Allbutt. There drugs were given me, but nothing produced sleep. *I prayed to be bled or leeched but was refused.* I then bribed the nurse to put fifteen leeches on my temples, after which I obtained, for the first time for many months, three hours' sleep. I was so pleased with the result that I dressed myself and returned home to my practice."

This is a remarkably interesting but very sad case, as he ultimately became an inmate of Bethlehem Hospital. His instinctive feeling of head congestion, his urgent desire for leeches, gratified by bribing the nurse and the temporary relief to the insomnia after their use suggest that the case may have been originally of a simple congestive type of neurasthenia and not an insanity. In the absence of other details it would not be possible to affirm this, but if it were so, early and repeated leeching with other treatment might have averted his dreadful fate. A single leeching never suffices for the cure of such a case, however great may be the immediate

relief; a relapse is inevitable, but it should be met by the same treatment.

The question as to the part taken by brain congestion in the early stages of certain forms of insanity is beyond the scope of this work, but the opinion just expressed that it may have had something to do in the above case is not without the support of clinical evidence. I was recently consulted on behalf of a married woman, æt. 46, who for more than six years has been subject to uncontrollable emotional disturbance, being constantly engaged either in weeping or laughing, attended by a uniform melancholy. Her father died in an asylum. Previous to the onset of this condition she had been an active business woman, but for the last six years she has been incapacitated from domestic duties, social intercourse, or business management. She had been diligently attended at home and away from home, but derived no benefit from drugs, rest, change, or other treatment. She had no delusions. I diagnosed an emotional insanity which was likely to develop in course of time into a more serious form. Convinced that no drug was worth prescribing, I, as a last resource, suggested leeching, though careful not to promise any good from it in such a case. The result was beyond all anticipation. The pulse fell from 92 to 72. The emotional attacks disappeared; she felt and appeared so bright that she wrote to her husband that she would soon return home quite well. In a few days she relapsed. A second leeching had very little effect, but a third was almost as effective as the first and the result more enduring. How the case will end it is impossible to say, but the present improvement (three weeks after the third leeching) is so great as to afford a reasonable hope that her cure may yet be effected, and confirmed insanity, the usual drift of this condition, be avoided.

I have diligently sought for any record of cases treated on this principle, but without success. There is a brief but interesting report by Mr. J. Brown, of-Bacup, in the "British Medical Journal" of January 3d, 1880, of three cases of insomnia and headache cured by bleeding, the cure being immediate and permanent, the headache disappearing before the bleeding was complete, and natural sleep was at once secured, though chloral and other sedatives failed to produce it. These cases prove what I am already convinced of, that venesection is in

some cases more reliable than leeching, as in the case of J. B., p. 586. I have also noticed a case recorded by Dr. Hare in his work on "Good Remedies out of Fashion," of severe and constant headache in a girl of several months' duration, which yielded to leeching, adopted after considerable opposition from the parents. The case illustrates a point I have already insisted on, that a relapse commonly follows the first leeching.

The best that can be said of a remedy is that it is safe and that it will act speedily. Both these advantages can be claimed for leeching and in suitable cases for bleeding from the arm. I usually begin with eight leeches, four over each mastoid process, applying them late in the evening and allowing the bleeding to stop naturally during the night. The usual effect is sound refreshing sleep, but even where this is not secured a feeling of restful calm is enjoyed.

When first I studied this subject I thought the affection was almost restricted to the well-to-do middle class, actively engaged in responsible, brain-taxing work, but I have since found some typical cases in humbler spheres of life. The following is an example: H. C., a coachman, æt. 50, married, a strong, muscular man with face and forehead deeply lined, depressed aspect, always temperate, states that he has been to so many doctors, finds nothing do him any good and feels ashamed to speak of his symptoms as he cannot explain his feelings, and feels convinced that no one suffers like himself. This is a common experience among these patients who fancy their symptoms are peculiar to themselves, and that being difficult to explain or understand it is impossible to cure them. He has never been well for twenty years, and the chief abnormal feeling is referred to his head. It is not actual pain but heat and fulness. His temples throb and he feels the pulsation of his vessels under his fingers. Giddiness occurs almost every day; he feels as though he were going to fall and tries to relieve the feeling by belching up wind, taking carbonate of soda, etc. Sleeps from 11 P.M. to 6 A.M., but feels in the morning as if he had had no sleep; often dreams horribly. Eats fairly well but without relish; he has a perpetual feeling of discomfort over the epigastrium, sometimes amounting to pain. Conjunctivæ dull and injected, pupils normal, carotids pulsate visibly, external jugular veins very full, veins of arm very large, probably from his work, as the arms are extremely

muscular, and he says the veins used to be larger than now. When first attacked, twenty years ago, he at times felt as though he could not see, yet at the same time conscious that there was no real defect in his eyes. When driving he feared to turn his head round and felt nervous when other vehicles passed him.

I prescribed arsenic and sumbul. He went to Tunbridge Wells for a month, but reported himself no better on his return. "Two hours' work are worse than eight should be to me; I feel awfully miserable and have a peculiar feeling in my head as though something dreadful is about to happen." He had tightness or stiffness (so described) about his eyes, with slight dimness. Radial and superficial volar arteries very visible.

I ordered six leeches at night. He had not a very good night, but in the early morning felt as if there were nothing the matter with him. After breakfast he did not feel so well. (This closely resembles the case described on page 550. That gentleman after years of illness slept well after his first leeching, felt quite well before breakfast, but relapsed to some extent soon after.) Although the improvement was obvious and maintained, having lost his misery and being able to look people in the face and do his work ever so much better, he did not feel right about his head. He was, therefore, again leeched, and in the morning he described himself as feeling *much stronger* and equal to the charge of six horses instead of one; positively happy and head quite clear. He ate a good breakfast with unusual relish. His aspect was much improved, face not suffused, eyes clearer, deep lining of his face partly effaced. I saw him a fortnight later. He stated that he felt much better in every way, was sleeping well, eating with more enjoyment, feeling equal to his work, which is now a pleasure to him, and he cannot endure being idle.

This case illustrates several points of importance. Observe the close resemblance to my introductory case, p. 550. They are in opposite social circles, but when well are active, strong, muscular men, free from any taint of or tendency to disease. They are both unfitted for work, not in the sense of total incapacity, but their state is such that every act is undertaken and endured with a sense of effort. Both feel quite well after the leeching, but relapse after breakfast. Both have gastric

and many other symptoms in common; repeated leeching is necessary, in both cases the congestive condition being relieved, their original active temperament is revived and idleness becomes insufferable, work a pleasure. Leeching is the true tonic in each case, and the coachman specially points out that, contrary to his expectations, he feels stronger after it. The cases have a further personal interest to me, representing the first, and at the time of writing, the last case treated by this method.

The following cases had their origin in fast living and overstimulation, both fruitful sources of brain strain, the antecedent of brain depression.

B. C., æt. 26, a strong, muscular, healthy-looking fellow, married; ten months ago while very actively engaged, in addition to his ordinary work (brewer's collector), in organizing a bonfire festival, he was attacked with a sudden pain in the heart, choking feeling in throat, and fear of impending death. This choking feeling returned from time to time for four months. It sometimes attacked him at night, and forced him to jump out of bed, sometimes at meals preventing him swallowing. He was restless and depressed day and night. His sleep was bad, unrefreshing, and disturbed by awful dreams; he often spent part of the night in walking to relieve his restlessness. He had frequent giddiness and an uncomfortable feeling all over the head, which was hot, but no actual headache. He was extremely nervous and miserable, and could hardly stay indoors night or day. He suffered in this way for four months, and then got much better, but had occasional vertigo. He now complains of a feeling about his heart, which inspires intense dread, some vertigo with a weary aching feeling about his eyes. These symptoms will probably yield to ordinary treatment without leeching, but a review of the case is interesting as it illustrates a special but not uncommon type of brain congestion. The attack was earlier than usual in this malady, and its onset was very acute. Its cause was alcoholism and the brain excitement of his bonfire sports. He assured me that he often drank large quantities of raw brandy without intoxication, although the same amount diluted would have rendered him incapable. The only explanation I can give of this is that the stomach would not absorb the raw spirit on account of its hardening powers over organic tissues,

and that much of it would thus be passed unchanged through the intestines. The symptoms were partly those of acute alcoholism, though in the intense restlessness, depression, insomnia, and peculiar nervous feelings extending over four months, there is an evident relationship to the acute form of congestive neurasthenia. I believe his original illness might have been shortened by leeching. (The nervous symptoms in this case not yielding to ordinary treatment as was expected, leeching was tried with the best results, the man asserting that he had never experienced such relief from any other remedy in spite of the fact that he was engaged in the exciting occupation of betting, electioneering, etc.)

A second case I may mention is that of a gentleman, æt. 28, married, of extremely vivacious temperament, active in mind and body, but unfortunately a thorough Bohemian in habits and tastes. To be in the least degree unhappy or depressed was a thing practically unknown to him, but he had now come from London to consult me as his depression was "something awful." He felt unstrung, good for nothing, would not mind if he were to lie down and die. His head was "indescribably queer," hot but free from pain; he had vertigo, slept badly, and dreamt vividly.

I stated in my description of the conditions antecedent to nerve depression that "honest labor with none but cultured and innocent pleasures may in one case induce that brain congestion, which in another is due to over-stimulation, over-excitement and dissipation."

These two cases illustrate the latter type. Their prognosis is always good, especially in first attacks. The principles of treatment are rest, withdrawal of stimulants, drugs are to be used with caution, as tonics are often ill-borne, and I think it safer, if there be insomnia with obvious signs of congestion, to leech than to give chloral, opium, or other sedatives.

The following case, in which trouble was the cause, I read at the British Medical Association Meeting of 1886.

J. B., a middle-aged man, a model of physical strength and, putting aside his careworn aspect, of robust appearance, a stranger to drugs and doctors till a few months ago, when, after the shock of a domestic calamity he became profoundly wretched and sleepless.

When I first saw him he complained of a dull aching all

over his head with intense depression, or in his own words, "my life is a misery to me." He could not keep at his work during the day nor could he remain inactive. His wretchedness never deserted him for a moment. His night restlessness was so great that he would often jump out of bed and wander miles in the middle of the night, and on returning find himself still unable to get a minute's repose, or forced again to rush away from home. He had occasional vertigo and a numb feeling in his left arm. He could eat, but dared hardly do so, on account of the great amount of flatulence which distended his stomach soon after food and caused violent and irresistible belching. This would often interrupt his meals, and force him to rush out of the room.

The skin of the face was somewhat turgid, the head hot, pulse full, tense and visible, about 70, veins distended and, in the arm, large and cord-like. To sum up, we have a fine, strong, healthy and temperate man (a total abstainer for a year before this break-down), suffering from melancholia, insomnia, and the so-called flatulent dyspepsia. Of course, like most such sufferers, he was convinced that his liver and stomach were the offending organs, and that if they were righted the other symptoms would go. On this theory he had been treated for some months by one of the most able and careful physicians of this town, but no medicine, of which he had taken freely, did him the least good. I carried out some preliminary treatment, sufficient to convince me how useless drugs were, and then ordered leeches.

According to the man's account next morning, he had bled freely and was none the better. It was, indeed, apparent from the state of his blood-vessels that the loss of blood had made no impression on him, and I decided to bleed from the arm.

With the aid of Mr. Morgan, our then House Surgeon at the Royal Alexandra Hospital, I bled him to thirteen ounces sitting up in bed. No faintness was produced, but he felt his head get better and the numbness went from his arm at the time. He had a good night, felt much better the next day, had a slight and only temporary relapse, *but the depression never returned.* He soon resumed his work and made a perfect recovery.

His slight relapse was probably similar to that which I always expect after a first leeching, but may have had some-

thing to do with his arm, which became painful at the site of the venesection, and had to be kept in a sling.

The sudden death of his wife was the nerve-shock which originated this state of melancholy. Up to that time he had never felt ill. His occupation (gas-meter factor) under ordinary circumstances brought no undue strain upon his nervous system.

His flatulence persisted for some time, although he did not consult me about it. It was relieved by medicine which his club surgeon gave him, but constantly returned. Finally, he was attacked with diarrhœa, after which it permanently left him.

The wretched restlessness of this man previous to bleeding was pitiable, and seemed to verge on that of a lunatic. Even while at his work he would suddenly rush out of his workshop again and again during the day, impelled by an uncontrollable feeling. Sometimes he wandered about nearly all night, causing the greatest anxiety to his friends who dreaded self-destruction.

He amused me by narrating the following: A few days after he was bled, he was watching the volunteers return home from the Downs after the review of 1885. An old gentleman observing his arm slung asked what accident he had met with. He replied that he had had no accident, but had been bled. "Bled," exclaimed the old gentleman, "I have never heard of such a thing since I was a boy. *It must have been a very old man who bled you!*"

This case illustrates the dyspeptic type of nerve derangement, all his symptoms being referred to the stomach, and on this theory he had been treated for several months without the least benefit. How easy for doctor and patient to assume that his was a liver case, and indigestion the cause of his nerve depression. On the other hand it is not easy to assure a man that in order to cure his indigestion he must first lose blood, in spite of his feeling so low and wretched, that, in his own words, his life is a misery to him.

The next case is not typical, as the patient had middle-ear disease with deafness and tinnitus aurium, but I quote it as a case in which the brain congestion of middle life, though associated with organic defects of the auditory apparatus, and probably even dependent on it, was nevertheless more relieved by leeching than by other means.

J. P., a healthy-looking man, æt. 40, married, good family history, never had any illness till July, 1883, when after some great anxiety he was attacked with giddiness and retching. He was confined to bed for three weeks, could not get up without vertigo, has ever since been very nervous, and never feels well. He has had similar attacks since, which prostrate him for a time.

I first saw him in March, 1884, he looked strong and healthy physically, but his aspect was heavy and depressed. His chief complaint was fulness about the head, roaring noise in ears and vertigo. He was prone to flushing of face and head on slight excitement or stimulation. He was much depressed in the morning. I gave him arsenic and nux vomica as tonics with aperient pills, fish diet and no stimulants. He was a most temperate man. His symptoms were alleviated but not lost; he had less vertigo, and his depression was not so great. On April 10th, he was leeched for the first time. His pulse fell from 84 to 72, he was relieved of the giddiness, felt lighter and more capable of exertion, and for some days had no feeling of fulness about the head. A week later his pulse was 72, soft and compressible, he had no vertigo, but the deafness and noise in the ears were as bad as ever. He found himself able to resume his work and perform his duties with ordinary effort. An interval of some years has elapsed since this leeching, and the patient has been free from his old attacks till lately. I have treated him with medicines, and induced him to have some weeks in the country. He has returned, however, with his vertigo and vomiting so severe that he asked to be leeched again. This was immediately done, relief was speedy, and he resumed his work at the end of a week.

This may be considered a case of Ménière's disease. It cannot be cured, but the relief of urgent symptoms dependent on congestion secured by leeching is notable.

As an example of the vigorous manner in which any lowering (so-called) measures are repudiated by the profession, I may mention a case sent from London to Brighton for change, who was suffering from well-marked congestive neurasthenia of several months' duration. He was in great distress when I first saw him, and finding the usual remedies afford no relief I ordered leeching. Great relief followed, which raised hopes of rapid improvement, but, as is common after a first leech-

ing, he relapsed, returned abruptly to London, and got the opinion from an eminent consultant, that instead of having blood taken out of him, he wanted some put into him.

That this is a fair representation of the views generally, though not universally, held will I think pass unquestioned. The man who received this advice was a strong, well-nourished, full-blooded dairyman of sound constitution, and who, previous to this illness, had never been incapacitated from work. Let me ask any rational authority whether it were better to give such a man more blood to distend the vessels of his brain, or take some away and relieve their tension.

The following case affords a parallel to that just quoted in its etiological and clinical features, that I report it in some detail, as my treatment was honestly carried out.

B. W. J., æt. 28, a strong healthy-looking man, though somewhat spare, never had any illness till nearly two months ago. He had been subjected to some worry and anxiety in changing his business. He first had pain at the top of his head. He had never previously had any pain, tightness, vertigo, or other abnormal head feeling. He was always intolerant of stimulants, which even in small quantities produced flushing of face and head. His present headache has been incessant for five weeks; it is worse on lying down, after walking in the heat, or after reading. He cannot read for more than five minutes, his vision becoming hazy, nor can he give attention to what he reads. He has no interest in anything except his own constant sufferings. He is extremely restless night and day, his aspect is dejected and careworn, and he feels wretched and hopeless. Appetite fairly good, tongue pale, moist, tremulous, with a few red papillæ. Bowels confined, not acting well even with aperients; constipation habitual. He has very bad nights, may sleep for about two hours, and keep awake for nearly the rest of the night. Has lost weight and strength, but not much. Pulse 108, firm and resistant. Has heat of head and other objective symptoms indicative of congestion. Has always been temperate. He attributes his illness to sun heat, but owns to having been worried by his business. Has been treated in London without the least improvement, and has been sent to Brighton for change.

Aug. 7th.—I ordered six leeches behind his ears, also a

draught of bromide of potassium, tincture of henbane, and chloroform water at night, and a saline aperient in the morning.

Aug. 8*th.*—Aspect much improved; describes himself as feeling much lighter and less depressed; much less pain and fulness in head; slept better; pulse 90; even, and softer than yesterday.

Aug. 11*th.*—Distinct relapse; head bad; mental depression intense; pulse 96; tongue coated; breath offensive. Again leeched; to take liq. pot. arsenitis in an effervescing mixture.

Aug. 12*th.*—Better but still very low; pulse 72; can lie down without distress (his head symptoms were always much worse when recumbent); tongue flabby and slightly coated.

Aug. 14*th.*—Has less head pain and feels brighter; head worse on lying down; sleeps better. Nape of neck and upper spine to be blistered; effervescing mixture to be continued; aperient pill at night; no draught (calmative). Pulse 96; evident flushing of face and head.

Aug. 18*th.*—Sleeps better than ever; less depressed and head feels relieved; thinks he could now work; pulse 84; tongue not coated but pale and moist. Ordered cold water shampooing of head.

Aug. 21*st.*—Says he feels "nicely;" pulse 72; slight discomfort about the head, but not at all marked; sleeps well, not restless in the day, and can always lie down in comfort. After the first shampoo he felt perfectly well for a time; the second had not such a marked effect.

Aug. 25*th.*—"Doing splendidly," with the exception of a slight pain at the occiput, he feels himself again; can read and sleep well; tongue clean and not tremulous.

Aug. 27*th.*—Returns home; feels somewhat weak but not a trace of depression.

The case is not an uncommmon type, and the difficulty of effecting a speedy cure by change of air, drugging, etc., is universally recognized in the profession. Yet his recovery was effected after fourteen days' treatment, for although he did not go home till the 27th of August, he felt and looked nearly well on the 21st, and the first leeching was on the night of the 7th. The treatment was unusually active, as his business affairs needing his personal attention, it was urgent to effect the cure as speedily as possible. Hence I leeched the first day I saw him. The effect of the leeching in lowering

the pulse was very marked. The first relieved the more urgent symptoms, and even in his relapse he was not so bad as when I first saw him. He then wore the aspect of despair, worried incessantly, was restless and incapable of engaging in the simplest work. The second leeching lowered the pulse more than the first. This is very frequently observed and affords convincing proof that the treatment is appropriate. The loss of blood is not more felt than in the first, usually not so much; the relief in bad cases is often greater, and the relapse of reaction is not so severe. Where the pulse is excessively slow, it should be quickened by depletion, where it is over 90 it should be reduced in frequency.

There are many cases in which venesection would, I am sure, be the most rapid and efficacious treatment. The case of J. B., p. 586, is an instance where leeching made no appreciable impression on the symptoms, while thirteen ounces of blood from the arm relieved the head immediately and permanently. My present experience of venesection is small, but I have no doubt it may be resorted to more frequently with the best results.

The following may be worth recording as illustrating the manner in which bleeding is discountenanced by even the seniors of our profession, whose early experiences might incline them to look more charitably on such a good old-fashioned remedy. A young professional friend, suffering from organic brain disease with partial paralysis, came to stay at my house. The paralysis was mending. During my temporary absence from Brighton he had an exacerbation of his symptoms, and another physician, an old friend of the family, was summoned. When I returned on the following morning, he had obtained no relief from his distress. He was confined to bed with intense heat and pain of head, slow full pulse, throbbing arteries, profound depression and acute anxiety as to another attack of paralysis. I at once sent for leeches, and while they were on, the physician arrived who had been summoned in my absence the day before. After seeing him and adjourning for consultation he urged me to remove the leeches, that bleeding was the worst thing possible for him, and that none of the family, of whom he had known two generations, could stand any lowering measures. So positive and earnest was this opinion that my confidence was shaken and I became nervous

for the result. Although I let the leeches have their fill, I stopped the bleeding, which was free, very soon after, contrary to my usual practise. I left Brighton in the afternoon, and the next morning returned to my house eager and anxious to know the condition in which I would find my friend. My first impulse was to rush straight upstairs to his bedroom, but I was arrested by a hearty laugh from the dining room and a call, "here I am," and to my intense relief I found he had breakfasted downstairs, he had slept splendidly, and his head was so light and clear that he declared himself better than he had been since his first attack. Needless to say how grateful he was for the leeching, nor could I refrain from telling him in what a state of suspense I had been as to the result.

I think it needless to record more cases to prove what I trust has been fairly demonstrated, that some people suffering from the most painful and unnatural depression may be cured by the much neglected and discredited remedy of "bleeding." The cases I have given in which other and carefully directed treatment has been unattended with the least improvement, although aided by every collateral measure that money could buy or medical skill suggest, and which have immediately yielded to bleeding, prove not merely its value but its absolute necessity as the only means by which the nervous system is restored to its natural condition.

I am not anxious to start or uphold any special theories as to its action; my purpose is sufficiently served if I indicate with proximate precision the chief clinical types in which the remedy may be resorted to with confidence. These types vary more than is here recorded. This work is far from exhaustive of even my own experience, for, after the manner of most men engaged in family practice, I make notes of but a small proportion of cases.

I have been reminded by a coach-builder that six years ago I leeched him for an intense headache, which constantly recurred in violent paroxysms, disabling him from work. He assures me it has never returned. I have not a note of the case, and the fact of having leeched him had entirely escaped my memory. Many such cases have occurred without my retaining any record. Nor is this brochure intended to be descriptive of every detail of treatment, nor of any one system of treatment in its entirety, nor of all the varieties of

functional nerve disturbance. Its chief object is to establish the value of a remedy which appears to be practically discarded by the profession; although, when discriminately applied, it is capable of relieving suffering as real and intense as any for which medical aid is ever sought.

THE

ART OF EMBALMING.

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CHAPTER I.

THE ANCIENT METHOD.

On the three methods of disposal of the dead most commonly practised in the different stages of the human history of this planet—viz., burial, or concealment of the body in the earth; cremation, or destruction by fire; and preservation, by "embalming"—many learned books have been written and much controversy has been waged. Which of the three modes was first instituted? What particular nations favored one mode in preference to the other? What was the ideal that prompted preference for either method?

As it seems to me, the natural course of history on this subject is exceedingly plain and simple. The custom of savage life, to leave the human dead to the carnivorous birds and beasts, passed readily enough, and with little development of refinement, into the more humane practice of hiding the bodies, from these animals, in the earth, and to the second primitive stage of disposal, which, on the whole, has outlived all other methods—viz., burial in earth. We trace this custom of burial in countries of wonderful civilization, even after other, and, as it was assumed, more refined, practices had generally replaced it. Thus, in Greece, where cremation was the established custom, and interment, except under special circumstances, was interdicted, the traveller who should find a dead body was enjoined to bury it, or, if he could not do so much, to cast dust of earth upon it three times—

> "Quanquam festinas, non est mora, licebit
> Injecto ter pulvere curras."

indeed, such was the anxiety of the early Greek in respect to

decent burial, that Pluto, who taught first the rites of burial, was raised, like Æsculapius, into the number of the immortal gods. No deeper curse could be passed from one person to another than that which conveyed the wish that the cursed should have no burial; so when the sailor died at sea, he was consigned to the deep with horror, bearing on his body the most costly gift he could bear, with the request that, if on some friendly shore he were cast and found, the finder would accept the reward for the trouble of burial.

Later on, in the course of civilization, new ideas sprang up respecting the continuance of man as a veritable existence, destructible or indestructible, or, as the poets would have it, mortal or immortal. As the intelligent part of human nature became developed, the value of that intelligent part rose in estimation, while, in respect to matchless intelligences manifested in man, it was accepted as impossible that with the dissolution of the grosser or material parts of the organism the whole could resolve. At the same time, the mind, unable to isolate its idealization of spirit and matter, could hardly receive the conception of a great intellectual unembodied force. Thus heroic men were crystallized into imaginary figures of gods, and in time the notion was conceived of retaining the matter for the re-reception of the spirit. Thereupon sprang forth two methods of disposal of the dead—one, the subjection of the body to fire; the other, the subjection of it to a process that should save it from decay. Strange it may seem, that two plans so different in effect should have the same origin. Yet the fact is so.

The institution of the process of burning the body, from whatever source or suggestion it may have been derived, had no touch of materialistic feeling. The men who transformed their greatest men into gods, and who carried out their young dead to the funeral pile before sunrise, that the sun should not be the witness of so terrible a calamity as the cessation of life while yet it had not neared its perfected glory, were not men tainted with the doctrine of negation after death. Not at all! The burning to which they subjected the dead body was to them a process of purification for the soul, which, left unclean in its earthly state, required to be made perfect by the absolute purification of the casement in which it had been enshrined on the earth. They subjected it, therefore, to the pur, the great

purifier—the fire. Further, they thought in this purification that they the sooner set free the indestructible principle of life, to enter the more speedily into the domains of the blessed. This was the Greek ideal of cremation; and it colors still many thoughts of man. It is the root of a faith to the present hour, though differently symbolized.

The process of embalming had its origin in a similar but in another current of development. The noblest human representation was by the Greek subjected to the most consummate purification, that it might be freed of dross of earth. By another intellectual process the effort was attempted to preserve the animal body so that it might, in the course of the suns, and at some strange and eventful moment, be united with the principle that had left it, and revivify. Again, in this ideal projection, we see the origin of a thought that remains still in the many thoughts of mankind, the root of a faith symbolized differently, but a faith of millions of our race.

The art of embalming, founded on this last-named ideal, developed—gained a second hold, I might say—from the lower or instinctive interests of humanity. It led to the retainment of those who on earth had been loved, and admired, nearer and longer, as it seemed, with those who lived to love, to remember, to admire. For this reason the practice of embalming great personages has retained its place, while recently, in a country among the most civilized and the most advancing —America—the practice has received advancement, not merely in its application to the great dead, but to the dead generally, among those in whom the tie of attachment is closest and most abiding. It is proposed in the next few pages to describe, briefly, the embalmment process as it was anciently practised, leaving the modern practice of the art for a future study.

The Ancient Art and Practice of Embalming.

The first notice we have of the art and practice of embalming comes from the Egyptians, and we are not only well informed of the methods they pursued, but are made cognizant of the results they obtained, by the specimens of preserved bodies which they have left to us. From their time the practice has proceeded, with certain modifications of detail, which

have come down to our own time. We may divide the practice into three parts:—

1. Into embalming proper, by the introduction into the body of certain odorous essences or antiseptics, aided by after-immersion in saline solutions.

2. Into preservation by simple extraction of water from the tissues—desiccation.

3. Into preserving by the injection of preservative solutions into the blood-vessels.

The first of these lines of practice includes the true Egyptian and Græco-Egyptian process of preservation, and it is most carefully related for us by the Father of History. Herodotus, travelling through Egypt, was struck by nothing more than the divisions of labor in learned work. The Medical fraternity he discovered divided into almost as many specialties as there were parts of the body; a fact to his mind—instructed as it must have been in the harmony and unity of natural phenomena taught by the higher school of philosophy in Greece—presenting a singular anomaly. Among other specialists he found the embalmers, a class hybrid between Medicine and Divinity, making a certain profession of both, yet hardly belonging to either. These professors of the art embalmed somewhat differently, according to the wealth of the embalmed and the fee of the embalmer. They were legally appointed to the exercise of their profession, and when a dead body was brought to them, they exhibited to the friends of the deceased different models highly finished in wood. The most perfect of these they held to resemble one whom the Father of History did not think it religious to name—this was the most expensive model; a second was of less price, and inferior in point of execution; and a third was meaner still. They then inquired after which model the deceased should be represented, and when the price was determined on the relations retired, and the embalmers proceeded with their task.

In the most perfect embalmments, they drew the brain through the nostrils, partly with a piece of crooked iron and partly with the infusion of drugs; they then, with an Ethiopian stone sharpened like a knife, made an incision in the side, through which they extracted the intestines; these they cleansed thoroughly, washing them with palm wine, and afterwards covering them with pounded aromatics. They next

filled the body with powder of pure myrrh, cassia, and other perfumes, except frankincense. Having sewn up the body, it was covered with natrum for the space of seventy days, which time they might not exceed. At the end of this period the body was washed, closely wrapped in bandages of cotton dipped in a gum which the Egyptians used as glue, and returned to the relations, who inclosed it in a case of wood made to resemble a human figure, and placed it against the wall in the repository of their dead.

The above was the most costly way of embalming. For such as chose the middle mode, from a desire of avoiding expense, the embalmers first filled syringes with cedar oil, which they injected into the body per anum, without making any incision or removing the viscera; they then closed the apertures of the body and laid it in brine the specified number of days, on the last of which days they removed the cedar oil which they had previously injected, and with it—such was the strength of it, as they thought—the viscera also, in solution; at the same time the natrum had reduced the flesh, so that there was nothing left but the skin and the bones. They then gave back the body without any further operation to the friends who owned it.

The third mode of embalming, which was used for such as had still scantier means, was as follows: After washing the inside with *syrmœa* the embalmers salted the body for seventy days, and then returned it to those who owned it.

Between four and five hundred years after Herodotus, Diodorus Siculus, writing on the same subject, shows how little the art had changed since the time of the Father. Those, said he, who have the care of ordering the body are such as have been taught the art by their ancestors. These, showing to the kindred of the deceased an estimate of expenses of each kind of burial, asked after what manner the body should be prepared, and when the terms were agreed upon the body was delivered over them, and they thus proceeded. First, he who bore the name of scribe, laying the body upon the ground, marked upon the flank on the left side how much was to be cut away. Then he who was called the cutter or dissector, with an Ethiopic stone cut away as much of the flesh as the law commanded, and presently ran off as fast as his legs would carry him; those who were present pursuing him, casting

stones at him and cursing him, thereby turning all the execrations which were due to his office on him: for whosoever offered violence, wounds, or any kind of injury to a body of the same nature with himself, they thought worthy of hatred; but those who were called the embalmers they esteemed worthy of honor and respect, for they were familiar with the priests, and went into the temples as holy men, without any prohibition. So soon, then, as one of these came to embalm the dissected body, he thrust his hand through the wound and drew out all the viscera except the heart and kidneys, after which another operator washed and cleansed the viscera with wine made of palms and of substances of aromatic odor. Lastly, having washed the body, the embalmers anointed it with oil of cedar (or cedria) and other aromatics for about thirty days, and afterward treated it with myrrh, cinnamon, and such like materials, which had not only the power to preserve it a long time, but to give it a sweet smell; then they delivered it to the kindred in such manner that every part remained whole and entire, no part of it changed, the shape and beauty of the face as before death, so that it could be known; even the hairs of the eyelids and eyebrows remaining as they were. By this means many of the Egyptians, continues Diodorus, "keeping the dead bodies of their ancestors in magnificent houses, see so perfectly the true visage and countenance of those that died many ages before they themselves were born, that in viewing the proportions of every one of them and the lineaments of their faces, they take as much delight as if the dead were still living among them."

We gather from these histories that the Egyptian method of embalming consisted really of eviscerating, of employing aromatic preservatives, and of exposure of the body to a saline solution—in plain English, pickling. It has been argued by some authorities that the exposure of the body to the saline substance was the first part of the process and the filling of the cavities with aromatics the last; but the whole argument, beyond what is stated by Herodotus and Diodorus, is merely speculative. It seems clear that the Egyptians used an aromatic powder—a mixture of myrrh and cassia—a strongly preservative compound; and it also seems clear that they used the oil of cedar, and that sometimes they injected this oil into the cavities. The saline substance they employed does not

appear to have been saltpetre, but either chloride of sodium (culinary salt), or a mixture of that salt with soda. The saline substance taken by Mr. Pettigrew from a Græco-Egyptian mummy, and chemically examined by the late Dr. Ure, proved to be composed simply of common salt. It is clear in some instances—instances, I presume, where the embalmer received his highest fee—that the description by Herodotus does not supply the details of everything that was carried out by the operator, for we find, in the actual mummies still remaining, the most extensive and skilful bandaging, and also evidence of the employment of bituminous substances—asphaltum and pissasphaltum. The former was a pure bitumen, called in later centuries *bitumen Judaicum* (Jew's pitch), while the latter was a mixture of Jews' pitch and common black pitch. To these was probably added the oil or essence of some aromatic, such as cedar. In some mummies this bituminous matter has been found in the cavity of the skull and in the ventral cavity; in other specimens the whole body had clearly been immersed in the bitumen before it was bandaged. The bandaging was made with light but rather coarse cloth, somewhat resembling canvas, and was carried apparently from the lower limbs to the upper part of the body, including the head itself, and back again, in layers, several times.

In the most costly specimens, gilding of the surface of the face and of other parts of the body was practised, and with such perfection that specimens of it have been retained in good preservation to the present day.

The results secured by the embalmers of Egypt in the ancient times, however crude they may seem, were good when the highest development of the art was practised by them. This is proved by the specimens that have come down to us. My distinguished friend, George Cruikshank, once made a drawing of the face of a Græco-Egyptian unrolled by Mr. Pettigrew at the Charing Cross Hospital, on April 6th, 1833. Mr. Cruikshank told me that the features of this preserved man, preserved over two thousand years, were so perfect, that there was no difficulty in the task of making an accurate representation of them. The soles of the feet were quite soft, and yielded readily to the pressure of the fingers, while, at the same time, they showed elasticity of structure. The face in this case had been gilded, as had also the upper surfaces of the

feet, the thighs, abdomen, and chest. The full account of this mummy will be found in Mr. Pettigrew's admirable work on the "History of Egyptian Mummies;" suffice it only to add now, on the authority of my friend, that the immortal Græco-Egyptian, embalmed and gilded regardless of the embalmer's highest fee, and lying over two thousand years in useless preservation, passed speedily in this commercial age into a means of affording quick returns on small profits. The last time Mr. Cruikshank met his antique friend, who gave him so strange a sitting, the said antique was enshrined in Seven Dials for the sake of being seen for the sum of one penny per visitor.

> "Imperial Cæsar, dead and turned to clay,
> Might stop a hole to keep the wind away."

My late friend's antique out-Cæsars Cæsar.

The term embalming is applied to the Egyptian art of preserving the dead because preservative balsam or balm was used in the process—*baal-samum*, prince of oils. Much speculation has been offered as to the kind of balm used by the Egyptians, and Prosper Albinus, learned in all such matters, describes with infinite care the plant yielding the balsam, the mode of obtaining it by incision of the branches (called *opobalsamum*), and the balm itself. The fluid was whitish at first, and turbid, of a strong pungent smell, like turpentine, but much sweeter and more fragrant, and of a bitter, acid, astringent taste; on being kept it became thin, limpid, light-greenish, and then of golden yellow; after which it again became thick, like turpentine, and lost much of its fragrance. Its smell resembled that of citrons, or rather a mixture of rosemary and sage-flowers. The use of this balsam was, I conclude, confined to the highest class of embalmments, and it was probably mixed with the other aromatics with which the cavities of the body were filled. Bodies thus prepared retained longest their natural condition of structure and feature.

The viscera removed from the body by the Egyptian embalmer were placed in a separate vessel, and, with a sort of funeral prayer, addressed to the "sun and all the gods givers of life, were cast into the Nile."

Such in brief was the Egyptian method of embalming, and, with a few modifications of detail, their method was copied by all the neighboring nations. The Jews introduced aloes

into their preparations, and some other changes from the primitive plan were carried out; but on these we need not dwell.

One marked difference of mode does, however, remain to be told. Herodotus records that the Ethiops desiccated the bodies of their dead, painted the dried bodies so as to represent life, and finally, enshrined them in columns of transparent solid substance, so that they could be seen by the living. For one year the dead man, thus crystallized, was kept in the house of his friends, after which time he was removed, and was set up in the town where he had lived. What the nature of the transparent substance used to envelope the dead might have been is not known. It has been assumed to have been glass; it has been assumed to have been amber, or a fossil crystal.

We travel from these early times through many centuries, never historically to lose sight of the art of preserving the dead by one or other of the methods named. Camerarius, the author of that quaintest of quaint old books, "The Historical Meditations," tells us that brass was considered to be a preservative of the dead, and that on this belief rests the custom of using brass in the coffins that receive the dead. He, too, quoting from Gyrald de Cambrea, affirms that people in the Isle of Arran will not putrefy after death, so that the bodies of the Arrans are naturally preserved. Further, he tell us, on the authority of Peter Martyr, that the Spaniards found at Comagna, in the New World, a chamber of a cacique full of the dried dead bodies of his forefathers.

The statement by Peter Martyr is sustained, in respect to the inhabitants of Peru, by Garcilasso de la Vega, who, however, described a process of preservation different from desiccation. The Peruvians, he says, embalmed the bodies of their kings by burying the corpses in sand, to dry them; after which they applied to the bodies a kind of bitumen, which kept them in such entirety, they seemed as if they had been alive. The same people of Peru have continued the practice of preservation, principally by desiccation, until a late day, the bodies of the dead being placed in sand and exposed to the heat of the sun. These bodies have commonly, when they are unearthed, a crouched sitting position; they are little more than skeletons covered with dried skin.

Pettigrew, quoting from Glass's "History of the Canary Islands," takes from a translation of an ancient Spanish manuscript an account of the manner in which the people of the Canaries preserved their dead. They carried the dead body in a case, stretched it out on a flat stone, opened it, and took out the bowels; then twice a day they washed the porous parts of the body—viz., behind the armpits, behind the ears, the groin, between the fingers, and the neck with cold water. After sufficient washing, they anointed those parts with sheep's butter, and sprinkled them with a powder made of the dust of decayed pine trees, and a sort of brushwood which the Spaniards called *bressos*, together with the powder of pumice stone; then they let the body remain until it was perfectly dry, when the relatives came and swathed it in dressed goat-skins, girding all tight with thongs of leather. The body was finally placed in a cave. In some cases among the Gaunches, the cavities of the body, after being washed with salt water, were made to receive aromatic substances, and the whole body was then dried in the sun or in air artificially heated. The same authority (Pettigrew) records that at Palermo, at the Convent of the Capuchins, the bodies of the monks were all preserved, the skin and flesh, by some process of petrifaction, being rendered quite hard, so as to resist decay. These bodies, habited in the clothes they usually wore, were preserved in the standing posure.

In Burmah the bodies of priests are still subjected to a peculiar process of embalming. The plan is to eviscerate, to fill the cavities with aromatic spices and honey, and afterwards to coat the whole external surface with a layer of vegetable wax, on which gold-leaf is laid. Another practice by these same people related by Pettigrew, on the authority of Captain Cook, a practice of thrusting hollow bamboo canes from the soles of the feet into the body, and of injecting preservative fluids through these tubes, is now unknown.

Embalming in a Later Age.

The methods of preserving the dead, as sketched above, have been limited to particular communities. But the universal method that prevailed for centuries was, practically, the Egyptian. By this method for two thousand years the great

potentates of the earth were held in a little longer suspension against nature, the mode of procedure passing down by tradition, and known but to a few practitioners of the art. Such modifications as really occurred in the art are quickly related. Lewis de Bils, in 1750, proposed to embalm without evisceration of the body. After him, Gabriel Clauderus, in 1769, introduced the plan of injecting into the cavities of the body what he called his "balsamic spirit," which consisted of one pound of salt of tartar, half a pound of sal-ammoniac, and six pounds of water. Into this same solution he also immersed the whole body, and allowed it to remain immersed eight weeks; after which he dried it in the sun or in heated air. Some time after Clauderus, it became the practice to make incisions into the bodies of the dead that were to be preserved, and to insert into the incised parts tincture of myrrh or other similar antiseptic substance. Lastly, there came into operation an improved covering for the embalmed—a cere-cloth coated with wax, oil, and aromatic preservatives. The whole process, as it was carried out a little more than a century ago, is described in the following directions by two of the ablest surgeons England has ever produced—I mean Benjamin Gooch, of Norwich; and the great authority of the last century in class-book surgery—Benjamin Bell, of Edinburgh.

"After evisceration," says Gooch, "as has been directed in opening a dead body, and continuing the incision farther upward—even into the mouth, and, if practicable, without cutting the skin of the neck—all the cavities are to be well cleansed, and the humidity sucked up with sponges, then washed with tinctura myrrhæ, and filled with a *species* compounded of fragrant herbs, aromatic drugs, and gums reduced to powder, not very fine, first restoring the heart to its former residence, after having opened its ventricles, cleansed and washed them with the tincture, stuffed them with the species and sewed them up; and then the cavities are to be stitched very close with the glover's or spiral suture. Large and deep incisions are also to be made in all the most fleshy parts, cleansing and washing them with the tincture in the same manner, filling them with the antiseptic species, and stitching them up. Then the head, trunk, and limbs are to be perfectly well covered with cere-cloth; putting a piece under the chin, to be secured by sewing on the top of the head; after having

well adjusted the cap of the skull, sewed the scalp together, and cleansed the mouth, as has been directed for the other parts, and putting in some of the species. The cere-cloth is to be prepared with a composition made of wax, resin, storax, and painters' drying oil S.A. After the application of the cere-cloth with great care and exactness, cut into suitable pieces, according to the respective parts, and closing them well everywhere, the face, being close-shaven, is to be covered with some of the above composition, melted and laid on with a brush of a proper degree of heat, and of a moderate thickness—and it may have a faint flesh color given to it with vermilion; and when it has grown cold and stiff upon this part, it may be lightly struck over with hard varnish—or this varnish, applied thick, may here serve the purpose alone. A cap is to be well adapted to the head, falling down upon the neck, and to be sewed under the chin, making a few circular turns about the neck with a roller of a fit breadth. All the rest of the corpse is to be inclosed in a sheet, to be artfully cut, and sewed on very close and smooth with the finest tape, over which an appropriate dress is to be put, as the relations or friends think fit to direct and appoint, and then laid into a coffin, which should be in readiness; but when it is some great personage, who is to lie in state for public view before the funeral rites are solemnized, the dress must be appropriate to his dignity and character. The brain and other viscera are to be put with some of the species into a leaden box. Sometimes the heart, prepared as has been directed, to preserve it from putrefaction, is deposited in an urn by itself."

The following, says Bell, is "the present method of embalming: The brain and all the viscera of the thorax and abdomen being removed, they are all, excepting the heart, put into a leaden box with a considerable quantity of an aromatic antiseptic powder, prepared with myrrh, frankincense, cloves, the leaves of lavender, rosemary, mint, sage, and other similar articles, and to these are added a proportion of any odoriferous oils. The blood being removed from the different cavities, and the heart replaced, they are all filled with the same kind of powder, with a due proportion of odoriferous oils or spirits, and the parts afterward sewed up. By some, too, the mouth and nostrils are stuffed with these powders and oils; and incisions are made into all the fleshy parts of the body, which

are also stuffed with them, and afterward sewed up. But there is no necessity for this, unless the body is to be kept for a great length of time, or to be carried to a considerable distance: in which case it is usual, after stuffing the incisions in the manner we have mentioned, to roll all the extremities, as well as the trunk of the body, firmly up with bandages, and to cover the whole with varnish.

"The body is now to be laid upon a cere-cloth of sufficient size, which must be applied with as much neatness as possible to the head and every part of the body, and must either be firmly secured by sewing or with tapes tied at proper distances. The cere-cloth is made of linen dipped in a composition of wax, oil, and rosin, which should be of such a consistence as to be sufficiently pliable, without being so soft as to stick to the fingers of those who apply it. It may be colored with verdigris, red lead, or any other article, according to the fancy of the operator. When two cere-cloths are applied they are usually made of different colors."

With Gooch and Bell, the ancient process of preserving the dead, by embalming proper, ceased, and a new era in the art was developed.

CHAPTER II.

THE METHOD BY INJECTION.

In the last chapter of this article a description was supplied of the ancient methods of embalmment, and the various modifications of the art were traced up to the time immediately preceding the labors of the distinguished Dr. William Hunter. Hunter, after Ruysch, introduced into this country an entirely new system of embalming, that, namely, of carrying out the process by injecting the dead body through the arterial vessels with a preservative solution.

The Method of Ruysch.

The credit is usually given to William Hunter of having originally invented the injection method. This is not strictly correct. Hunter did much to make the new plan known, and he also deserves great credit for having practised the plan with remarkable success. The full credit must, however, be attributed to the illustrious anatomist of Holland, Frederic Ruysch. This anatomist while filling the chair of anatomy at Amsterdam between the years 1665 and 1717, brought the art of injection of dead bodies to such extreme perfection that his specimens were the wonder of the age in which he flourished. Among other distinguished persons who came to see the work of this anatomist, was Peter the Great, and so struck was that strange monarch with the specimens which were put before him, that it is said he kissed the lips of a child which Ruysch had preserved. So lifelike was the face that, at first, the Emperor did not detect that it was the face of a child that was dead.

It is also said that by the method adopted the color of the body was maintained, with the complete form and suppleness of the limbs, but for what length of time these conditions were present we have no account. As none of the bodies so pre-

served remain entire, to testify to the perfection of the Ruyschian method, we must, I fear, accept some parts that are declared of it with the usual grain of salt. The inventor died, leaving a wonderful set of injected portions of the body behind, a cabinet of which was bought by Peter the Great and carried to St. Petersburgh, and we may perhaps honestly consider him to have been not only the inventor of the plan of treating by injection of preservative fluids, but the most skilful injector who has ever lived. He was selfish enough to depart from the scene of his neighbors without communicating his secret, whatever it was, to any one. The improvement he made is, therefore, lost, except in respect to the method of using the preservative by the process of injection.

William Hunter's Method.

William Hunter followed Ruysch in the plan of forcing a preservative fluid into the dead body by the blood-vessels. He injected by the arteries, selecting generally the large artery in the thigh, the femoral, for the vessel into which to insert the nozzle of the syringe.

The particulars of his plan are rather minute. In the first place, he injected into the crural arteries a solution compounded of oil of turpentine, Venice turpentine, oil of lavender, oil of camomile, and vermilion. This solution was forced into the vessels until it had made its way over the whole of the body, and had produced a general redness of the skin. The body was now allowed to remain for several hours untouched, to permit of the diffusion of the injected fluid completely through its structures. When this part of the process was completed, the operator returned, and proceeded to lay open the body as if he were making a post-mortem examination. The viscera of the chest and abdomen were removed, the fluid in them was squeezed out, their vessels were injected with the preservative solution, and the organs were steeped in camphorated spirits of wine. Then through the aorta more of the preserving fluid was driven, and the cavities of the chest and abdomen were washed with camphorated spirit. The viscera were next replaced, and the intervening spaces were filled up with a powder of camphor, rosin, and nitre. The same powder was put into the nostrils, mouth, and other external cavities,

and finally the body was rubbed over with the essential oils of rosemary and lavender.

The body thus treated was placed in a coffin upon a bed of dry plaster of Paris, by which all moisture was to be extracted from it. The coffin was closed up for four years, then it was to be opened, and at the end of that time, if the desiccation were not complete, another bed of plaster of Paris was to be added. "This was the method," says Mr. Pettigrew—in whose book the details will be found at greater length,—"by which the wife of the eccentric Martin van Butchell was embalmed by William Hunter himself." "The specimen," Mr. Pettigrew adds (it is still preserved, by the way, in the Hunterian Museum), "resembles a Guanche or Peruvian rather than an Egyptian mummy; and is, properly speaking, a desiccated rather than an embalmed body."

Hunter's Embalming Solution.—The formula is:

Venice turpentine, . . .	1 fluid pint.
Oil of lavender, ...	2 fluidounces.
Oil of rosemary, ...	2 fluidounces.
Oil of turpentine, ...	5 pints.

Hunter's method was afterward practised by Dr. Matthew Baillie, with this variation, that instead of removing the intestines or other viscera, he (Baillie) injected the preserving fluid into the stomach and rectum, and into the lungs by the windpipe, after he had thrown the solution round the whole of the body by the arteries. A surgeon, named Sheldon, also carried out a similar method, except that he used for his preservative camphor dissolved in spirit, in the proportion of one ounce of camphor to six ounces of spirit, and the success of the experiment was complete. In this case the viscera were removed from the cavities, and were coated with tar. The visceral cavities were also coated with the same. The external surface of the body was covered with a tarred sheet.

In order to comprehend the perfection to which William Hunter attained in the art of preservation, by the process of injection, it is necessary to visit the museum which he has left behind him, and which still remains in splendid form in the University of Glasgow. There are to be found, in that museum, [illegible] preserved faces of children which [illegible] to the life to a degree quite startling.

When I last saw one of them a few years since, it occurred to me that if the parents of the child could look at it even now they would not have the slightest difficulty in recognizing it. There is, I believe, no specimen of the kind in existence like to it. The head is divided into two lateral halves, and each half is preserved in a separate jar. The view therefore of the face, on either side, is in profile, but by bringing the two jars close together a fair idea of the appearance of the full face can be obtained. The face resembles that of a boy about four years old and of engaging expression. The lateral view of the brain is remarkably clear, and the medulla oblongata is more sharply defined than in any other specimen that I have ever had under my observation. The color of the hair as well as of the skin is most natural, the injection seeming to have undergone no deterioration. although the specimen is surrounded by spirit. The color of the hair, a reddish brown, is also well preserved.

Madden's Process.

The plan originated by William Hunter held its place, with very slight modifications, for several years. Joshua Brooks, the last of the great English anatomists, who had a distinctive school of anatomy of his own, practised this method.

But according to Mr. Pettigrew, Mr. Madden succeeded in bringing home, by sea, from Naples to London, the body of a youth preserved in tar. The voyage, which was long and perilous, lasted seventy-two days.

Process of M. Boudet.

The next change of the process was made in France, by M. Boudet, who introduced the use of corrosive sublimate into practice as the preserving agent. This experimentalist followed very closely the method of the ancient Egyptians, only that he employed a different agent for preservation. He laid open the large cavities of the body, incised the viscera, and covered them as well as the walls of the cavities with an alcoholic solution containing bichloride of mercury. After this, he added a layer of varnish, and then filled up the space remaining in the cavities with aromatic powder. He next sewed the incised parts neatly together, and, having varnished the whole of the skin, powdered it with aromatic substance, covered

it with several bandages, and over the bandages spread another layer of varnish.

With Boudet the system of simply treating the inner and outer surfaces of the body with the preservative died out altogether. His plan was superseded by the process of Tranchina, who followed Hunter in injecting the arteries, but who employed a different fluid substance for injection.

Processes of Tranchina and Gannal.

Tranchina first made use of a substance that had to be heated to become fluid, and which became solid on cooling. After a time he gave up this plan, and simplified it by using a simple solution composed as follows:

Arsenic, ...	2 lbs.
Cinnabar (for coloring), ...	1 oz.
Spirits of wine (by weight), . . .	20 lbs.

This solution was injected through an artery until all the tissues were charged with it.

After Tranchina, M. Gannal introduced a solution, to be used in a similar manner. He held the composition of the solution as a secret, but it was soon discovered to contain arsenic. The practice of embalming with these arsenical solutions having become common in France, the Government of Louis Philippe issued an order in 1846, declaring that the sale of arsenic, and of all compositions containing it, was prohibited for soaking grain, for the destruction of insects, and *for the embalming of bodies.* Later, the use of corrosive sublimate was, in like manner, interdicted.

In 1847, Gannal maintaining that his preservative did not contain arsenic, but was a saturated solution of equal parts of sulphate of aluminum and the chloride of the same metal, a Commission of the Academy of Medicine was appointed to inquire into the subject. A solution presented by the inventor was examined, and found to contain arsenic, whereupon it was excluded from public use.

Some Other Methods.

The injection of sulphurous and carbonic acids into the arteries in the form of vapor—the acids being produced by the

quick action of sulphuric acid on charcoal—was suggested by a chemist named Dupré, but the results were not favorable.

Another suggestion was by M. Robiere, who proposed to use rectified wood spirit in which camphor had been dissolved, as the preserving solution. This was clearly a return to the plan that had already been carried out in England by Sheldon, and that it did not prove satisfactory in Robiere's hands is indicated by the fact that he recommended it should be supplemented by the application over the body of a coat of varnish.

When I was making a visit to Paris in the year 1867, I was shown portions of the body of a lady which had been preserved, I was told, by some process which had never been revealed. In this specimen the muscles of the arms and thighs had been dissected out with considerable care, as for anatomical purposes, and they were in a state of remarkable preservation. They were also naturally supple, and yet sufficiently firm to admit of being handled. They felt to the hands greasy, but they left no stain on the skin, nor unpleasant odor. The most objectionable part was that the whole of the structures thus preserved were as black as ebony, and refused, I understood, to receive any coloring principle that would give the idea of natural appearance. I was informed by the exhibitor that the process had been used for embalming, and that from the circumstance of its leaving the whole body supple as well as fresh, it was exceedingly effectual; but that the objection made to the color prevented its successful introduction into practice. From the general appearances, I came to the conclusion that the secret preservative used in this case was nothing more than sulphuric acid, and I afterward made some experiments of injecting the vessels of a dead animal with sulphuric acid diluted with water, which showed to me that the supposition was correct. The muscular structure in these instances becomes as if it were partly charred, but it remains quite flexible, owing, I think, to an after absorption of water by the acid from the atmosphere. For the purpose of embalming, this process, as it now stands, is inapplicable, but if by any means the muscles preserved by it could have a fleshy color communicated to them, it would be an invaluable method for the demonstrator of anatomy, since by this means he could preserve careful dissections of the natural parts for many years, ready for demonstration.

Simple wood vinegar has been used by some embalmers for injection of the vessels. This application came from an observation made in 1833 by the distinguished chemist Berzelius, who examined a body kept by this means in perfect preservation twenty years.

M. Sucquet's Process.

At the time when M. Gannal's process was before the Academy of Medicine, M. Sucquet presented a preservative solution for embalmment that was free of arsenic. It was a solution of chloride of zinc. Experiments were made by the Academy with this solution, and with M. Gannal's sulphide and chloride of aluminum solutions. Two bodies were embalmed, one by Sucquet's, the other by Gannal's process. The bodies were buried for one year and two months, when the one embalmed by M. Gannal had undergone putrefaction, while the one embalmed by M. Sucquet was in perfect preservation. Exposed to the air, the latter dried without the least putrefaction, and acquired a degree of hardness comparable only to that of wood or stone. Sucquet's method has been most extensively used, both on the Continent of Europe and in America. I have used it several times, and although it admits of great improvement, it is, on the whole, the best preservative system known for embalming purposes by the process of injection.

Falcony's Desiccating Process

About thirty years ago an ingenious French experimentalist by the name of Falcony brought out a mode of preservation which, for the end had in view, was exceedingly useful. Falcony did not aim to preserve the bodies of the dead in their natural state, so that they might be recognizable for a long time after death, but he desired to introduce a perfect temporary plan by which the dead body which could not be immediately buried might be retained near to the living, and yet be, in no sense, a source of danger. In this object he succeeded in a remarkable degree, and by a process so simple that any one could carry it out.

The method is sometimes called the dry process, and consists in placing the body in a bed of dry sawdust, to which

common zinc sulphate has been added in powder. That which takes place under these circumstances, is that the body slowly dries up or desiccates. The water of the dead tissues is given up to the zinc sulphate, and from it to the sawdust; then the sawdust yields its moisture to the air, and in a few days the body, without throwing off the slightest odor, becomes like a Peruvian mummy, and, although bereft of all its natural features and appearances, is completely preserved.

The opportunity was afforded me of observing the operation of Falcony's plan, soon after it was introduced. In the Grosvenor Place School of Medicine, to which I was then attached as lecturer on physiology, the method was put to the test in the dissecting room, on the remains of subjects which were waiting to be removed for burial. The results were singularly perfect in so far as the completeness of the preservation was concerned. Since that time I have several times had occasion to recommend the same plan in cases in which it has been necessary to retain the dead an unusually long time before interment, or where the necessity has existed for conveying the dead a long distance previous to interment.

As it is important for medical men to know how to carry out this plan, it may be well to add that for all ordinary purposes when it may be required it is simply necessary to mix intimately two pounds' weight of common sulphate of zinc in powder with as much sawdust as will suffice to cover the body altogether. If objection be taken to the powder coming into direct contact with the remains, it may be put into fine linen cases or pillows, but it is not then quite so effective. The shell in which the body lies need not be closed in any hurry, but a thick layer of the powder must always intervene between the body and the outer air.

CHAPTER III.

EMBALMING AT THE PRESENT DAY.

EMBALMING at the present day is, in England, an exceptional process, and when we are called upon to perform it here, it is, in ninety-nine cases out of the hundred, for some one foreign to our country. I have embalmed fifty bodies, but only in two or three instances the bodies of English people, and in these exceptional instances the deceased, although they were born and died in England, had lived the greater part of their lives abroad, and were embalmed in order to be conveyed to friends at a distance, who wished to bury them. In the United States of America the embalming process is carried out to a great extent, and I believe the number of persons embalmed in that country increases every year. Hence, Americans who are residents here often ask to have friends or relations embalmed.

The reasons assigned for embalmment are numerous—some are valid, some perhaps fanciful. In most cases in which I have been consulted, the object of the embalming has been to retain the body free of putrefactive change long enough for it to be conveyed from the place where it died to some distant place where it is finally to be entombed. This object is in every sense reasonable. In other examples the embalming has been sought for in order that the relatives might retain the dead body as long as they could with the face exposed to view. For such purpose coffins of a special kind have to be made, in the lid of which a pane of glass is placed. In England these receptacles for the dead are not often constructed; but in America they are specially constructed, and I learnt that one body which I embalmed in England was, on its arrival in America, transferred to the particular receptacle described, in which (with the face perfectly preserved) it is retained.

I offer no opinion as to the value of embalming, because the question involved in it is one entirely of feeling. I may only add that the process is harmless to everybody; it in-

volves, I mean, no breach of sanitary rules if it be properly conducted.

Once I knew the embalming requested from the last direct wish of the deceased, who feared unless this precaution were taken she might be buried alive. It was not necessary, of course, to embalm to insure against that terrible calamity, but the desire had to be carried out. The lady was afterward buried in the usual way.

Embalming is sometimes performed on distinguished persons as a supposed mark of distinction. For ages upon ages this intention has been acted upon, and has become, in a certain sense, a fashion. Probably, if the distinguished personages who were embalmed with so much care in ancient Egypt could have foreseen to what base uses their preserved remains would in the course of time come—that they would stand, in fact, as the shows of another civilization—they would have been anxious to have been consigned at once to the earth after their deaths, or even to have been resolved on the pyre. Yet to this intention of embalming there are two sides. To the historian these remains of what once were mighty men possess an interest of no mean character, and he who would wish to trace the correct line of the Pharaohs, regrets, I doubt not, sincerely, that the embalmers of these royal personages were not more successful in their art. It must be admitted, however, that this object of embalming has been abused. To embalm a distinguished man that he may lie for long periods in the embalmers' room to be stared at by multitudes of people as a pseudo-scientific sight, is a degradation of scientific labor.

Occasionally, the art of embalming may prove of service for the benefit of the public—that is to say, for the promotion of public justice. It may be necessary to embalm a body in order that it may afterward be identified; or it may even be necessary to preserve the whole or parts of a dead body in order that it, or they, may be submitted to analysis or other mode of investigation.

There is yet another object for the public good in which the skill of the embalmer is useful. There are circumstances when it is not possible to bury a body immediately, and where it is necessary to keep it in such a state that it will undergo no decomposition, nor be calculated to be injurious to the living who are near to it. Here it is of moment to know how

temporarily to check the decomposition and prevent the diffusion of poisonous gases from that source.

I have dwelt for a few moments on these details of embalming, without minutely arguing any point that may be raised upon them, in order to show that the art is one that is demanded on various grounds, and is not likely to fall out of demand. As this is the undoubted fact, I think it is right for medical men to retain and even to cultivate the most perfect knowledge of the art. If we do not scientifically carry it out, other men, mere empirics, who know nothing either of chemistry or of anatomy, will attempt to do so, the public will be defrauded, and an art, which really rests on the purest basis of science, will be brought into unmerited disrepute.

There is nothing so difficult in the process, but that any practitioner can perform it as easily as he can perform a post-mortem examination; and when he has before him the simple rules I shall lay down in the next chapter, he will find the task easy. One quality only does it call for, and that quality is patience. It is true that in these days we are rapid to a marvel when we compare ourselves with our old friends the Egyptian embalmers, for we require hours where they required days. But still, to do the thing well, some considerable patience is demanded even now, notwithstanding all our modern knowledge and modern appliances.

The Latest Methods.

In the course of modern experience many changes have been introduced by which the various steps of the process of embalming have been much simplified. I now propose to describe, for professional service, the latest advances, and that so plainly that the youngest member of the medical body who has entered the field of practice may, by following what is told, be competent for the duty. Up to the year 1875 the usual method of embalming was by exposing an artery, introducing into it a curved hollow needle, and injecting through the arteries the preservative solution. The solution was composed of chloride of zinc dissolved in water with the addition of alcohol.

Five pints of water at 50° F. were treated with the zinc chloride just up to saturation, and to this one pint of 0.830 alcohol was added, with two fluidounces of the officinal hydrochloric solution of arsenic.

CHAPTER IV.

EMBALMING SIMPLY—WITHOUT A POST-MORTEM EXAMINATION OF THE BODY.

The Instruments Required.

The instruments required for modern embalming are few and simple. An ordinary post-mortem case is necessary, an aneurism needle, a tube for insertion into an artery, and a long, narrow-bladed bistoury. For the arteries the slightly curved tube which I introduced some years ago for transfusion of blood answers exceedingly well.

Another instrument required is one for throwing the preservative solution over the body, through the arteries. The old-fashiond flute-valved stomach-pump serves the purpose fairly, but a large graduated bottle which will hold six pints of fluid, and which can be fitted like a Wolff's bottle, is preferable. When this bottle is charged with the fluid, the short tube, passed through the cork, can be attached to a double-acting india-rubber hand-bellows, and a long-india-rubber tube can be connected with the exit-tube which comes from the bottom of the bottle. The long tube is armed at the free end with the artery tube. After the artery-tube is fixed in the artery, the bottle is raised above the level of the subject, and then the fluid in the bottle will flow into the vessels by a gentle action of the bellows. By this method of transfusing the fluid, one hand of the operator is left at liberty; the fluid flows easily and rapidly, and the qauntity of fluid injected is measured with ease and precision. It is well to put the fluid into the bottle and attach the long tube before going to the embalming; then the different steps of the operation can proceed without the delay otherwise incidental to the preparation. Whether this precaution be taken or not, the solution should always be made some time before it is used, and should be quite ready for injection.

Before commencing to inject with the preserving solution, the body to be embalmed is divested of all clothing, and covered with a loose cloth or robe. It is laid recumbent on a table about two feet. six inches wide, seven feet long, and two feet four inches high. A second smaller table, standing a foot or a foot and a half higher, for holding the bottle containing the embalming solution, is very convenient.

If the rigor mortis have not yet passed off, the limbs of the subject are gently flexed and extended until relaxation takes place.

Some operators lay the body to be embalmed in a hot bath before they commence to inject the vessels. This is often done here by those who inject subjects for dissection with solutions of wax; and for the latter purpose the plan is useful. In embalming, the bath is really unnecessary, and the additional trouble of it is very great, although the fluids run more easily through the vessels when the bath is used. Should the operator, therefore, not mind the trouble, he may place the subject in the bath, but he must be careful to keep the temperature of the water under 140° F. If that temperature be exceeded, he will produce so much muscular and vascular rigidity that the flexibility of the vessels he was seeking to secure will not be obtained. On the contrary, the vessels at their peripheral extremities will contract and resist the injection firmly, and it will be found difficult to force the fluids through the round of the circulation.

Mode of Injection.

The subject prepared, as above directed, the operator must determine on an artery through which to inject. In cases where the upper limbs are well developed, the brachial artery may be selected, the vessel on the right side being the most convenient. If the upper limbs be not large, it is a saving of time to select the femoral artery in Scarpa's space, for often under such circumstances the brachial is not found of a convenient size after it is exposed, and then the opening that has been made has to be closed, and the femoral artery has to be exposed afterward. Should the brachial be the artery selected, it must be laid bare in the upper third of its course, in the same way precisely as if it were about to be tied there. It

should be exposed for a full inch and a half, and should be well lifted up from the surrounding parts. A small opening should then be made in the line of the vessel and the injecting tube inserted; the point of the tube should be pushed into the artery toward the heart for a distance of an inch and a half at least, and then it should be tied in two places an inch apart. The tube may, finally, be tied down to the arm with a portion of tape to keep it firm in its place. When the tube is thus inserted into the artery, and fixed there, it is advisable, as a preliminary step, to attach the double-acting bellows to the tube, and to inject into the arterial vessels a gentle current of air charged with vapor of ammonia. It is easy to effect this by simply drawing the air with which the bellows are filled from the neck of a bottle containing a few drachms of strong solution of ammonia. This injection of alkaline air renders the after-injection of fluid less resistant, and the ammonia is itself an antiseptic of considerable value.

Disconnecting the hand-bellows from the tube that is in the artery, the operator proceeds to connect them with the short tube of the Wolff's bottle, and next he connects the india-rubber tube, attached to the long tube of the bottle, to the tube that is tied in the artery. In this way the communication for the injection of the preserving fluid into the arterial system is completed.

By the action of the bellows the operator proceeds, from this stage, to press the fluid into the body through the arterial circuit. He can hardly press too slowly or gently; and, if after the first pressure the fluid begins to run in of its own weight, so much the better. The most successful injections are those where the force employed is the least. If the fluid is entering the vessels properly and filling them, the proof of the fact is obtained by making a few strokes with the bellows, and feeling at the same time for the motion at some part of the body where an artery is near the surface. If the radial artery, for instance, be felt for at the wrist in the arm that is untouched, he can detect the motion with each stroke of the bellows precisely like the living pulse itself. Or if a stethoscope be placed over the base of the heart, with each stroke of the bellows the tension of the semilunar valves can be heard as they are driven down tense by the pressure of the fluid upon them. There is heard, in fact, a sharp second

sound. From either sign, pulse or heart-sound, if it be present, it is clear that the injection is passing properly into the tissues.

When from a pint to a pint and a half of the fluid has been thrown into the arteries, one or two needle punctures are made in the extremities, through which punctures a little of the injection may escape. This operation serves two purposes: it shows, so soon as fluid is presented at the openings, that the whole of the tissues are being charged; and by allowing for escape of a little fluid it prevents rupture of vessels within the cavities. The loss of an ounce or two of fluid from the punctures makes no difference in the success of the embalmment.

As the fluid completely charges the organs and structures of the body, a change begins to appear on the surface of the skin after from four to five pints have been introduced. The change usually commences in the face, but soon extends over all the surface of the skin, and it consists of a white mottling of the parts. The white-looking points run in irregular groups, each white spot being about the size of a split pea; and the spots, when they are felt, are hard. They do not in any way disfigure, and after a time they disappear.

When the mottling is present in various parts of the body, the indication is given that almost sufficient injection has been introduced. A pint more may, however, be slowly injected, and then the process may cease, at all events for a time. To carry out all the steps of the embalmment so far, a period of two hours is required.

This stage of the embalming reached, an interval of at least six hours is allowed in order to permit of the perfect diffusion of the preservative fluid through all the tissues of the body. Six hours is named as the shortest time necessary, but there is no objection for the time to be prolonged nine or twelve hours. If it is quite convenient, it is, indeed, as well to perform the injection at the close of the day, and to leave the body until the following morning. The arterial tube should be left in the artery, and the conveying tube should be left attached to the injection-bottle, so that fluid may continue to enter by its own pressure.

After the body has been left in the manner described, and for the period named, it will be found, if the embalming has

succeeded, very white over the whole of its surface, and exceedingly hard. The mottled appearance will have passed away, and will have been succeeded by general marble-like whiteness. The muscles will be rigid, and the limbs fixed. The body, practically, will have been turned into an almost stony hardness; but the features will be retained with wonderful perfection, and even the expression of the face may be considered singularly lifelike. Usually the muscles of the face, by which expression is marked, set very firmly; and friends, as a rule, identify the expression as like one that was common to the face during the existence of life. In this state a cast may be taken from the face with advantage.

The complete solidification of the tissues of the body makes perfect the process of injection; but it is not in every instance the fact that the diffusion is immediately completed, and many circumstances may interfere with the general distribution of the fluid. Some of it may have escaped by a rupture of vessel into the cavities, and so out of the tissues; and sometimes from a cause not easy to understand, the process of hardening of the muscular fibre and of the skin may not progress in the usual way, and the limbs may remain flaccid. Under such circumstances the injection-bottle must be recharged with the preserving fluid, and the injection must be repeated in the same way as before. It is very uncommon for this second process to be called for.

Presuming, then, that the complete rigidity has been obtained, and no further injection is wanted, the operator may proceed to close up the artery through which the fluid was introduced. A very simple plan effects this object. Before removing the tube from the artery he disconnects it from the india-rubber tube that goes to the bottle, attaches to it another and fresh piece of tubing, and then with a syringe injects into the artery a few ounces (four to six ounces are sufficient) of a saturated watery solution of silicate of soda. As the silicate comes in contact with the remaining chloride of zinc left in the artery it undergoes the most perfect coagulation, and leaves the arteries full for several inches, with a firm colloidal plug. After this the arterial tube may be removed, the artery may be tied firmly, and the opening through the skin may be neatly closed with silk sutures. If the stitches be carefully made in the form of the common anatomical stitch, hardly a mark

need be left to show the point where the artery had been exposed.

It has been said that in some subjects, owing to the smallness of the upper limbs, the brachial artery does not answer for the injection. In such an instance the femoral artery should be chosen. The operation is precisely the same as that which is performed on the living subject in Scarpa's space for ligature in cases of popliteal aneurism. The femoral artery is found more easily than the brachial, as a general rule, and the arterial tube is more easily inserted into it. It is, I doubt not, from these facts that the femoral artery is most frequently selected by the professed embalmers. The arterial tube is directed into the artery with its point toward the abdomen; it is inserted for the full length of an inch or an inch and a half, is strongly tied with two ligatures, and afterward firmly bound to the limb with a band of tape. The other steps of the process of injection are the same as have been described: the fluid is injected toward the heart, and after the body has hardened sufficiently, the vessel, plugged with silicate, is tied. The opening through the skin is closed neatly with the silk suture.

After Procedure.

So soon as the embalmed body is sufficiently solidified by the hardening and preserving fluid, certain other minor but still important details have to be carried out. It will be found usually that the cavity of the abdomen is left somewhat distended with gas. To remove this it is necessary to insert a pointed hollow needle and make the gas escape through it. This is effected by pressing firmly on the abdomen until it is emptied, after inserting the hollow needle; but since the introduction of the aspirator syringe that instrument is best for the purpose. The emptying is continued until the abdomen has fully collapsed; and if any difficulty is experienced in carrying this out, it may be requisite to make an incision through the intestines. This is done by the use of a long, fine bistoury, the blade of which can be introduced at the needle-opening into the cavity. A few movements of the blade of the knife, internally, are sufficient to lay open the canal for the escape of the gaseous matter.

When the abdominal cavity is in this manner emptied,

there should be thrown into it through the hollow needle six fluidounces of zinc colloid, made by dissolving zinc chloride in collodion and alcohol in the proportion of five grains of the zinc salt to one fluidounce of alcohol and one of collodion. The chloride, by diffusion, coagulates the mucous secretions and the intestinal structures and membrane. The opening made into the abdomen with the needle or bistoury is closed with a stitch of silk.

From the abdomen it is necessary to proceed to the thoracic cavities, into each of which the hollow needle should be passed in the anterior aspect between the third and fourth ribs. Through the needle four ounces of the zinc colloid should be injected into each cavity.

After the body is perfectly embalmed, and the openings that have been made into it have been neatly closed, it should be swathed very evenly in bandages that have been saturated with carbolic colloid, made by dissolving carbolic acid in collodion in the proportion of twenty grains of the acid to the ounce of collodion. The bandaging should commence at the feet, each lower limb being separately encased; above the hips the bandages should cross, and should be passed in alternate crossings so as to encase the trunk quite up to the neck. At this point they should again be made to diverge, and should be extended down the arm on either side to the wrists, where each should terminate. The hands and face are left exposed.

The attendants may now clothe the body, and dress and arrange it as they please, which process finished, the removal of the body to the casket in which it is to lie should be effected as quickly as is convenient. Should it be intended to convey the embalmed body by sea, one additional precaution is essential: the casket must be closely packed between the body and the lid with layers of blanket or pillow. This prevents concussion from the motion of the ship.

The body can be retained in a closed casket for any length of time without any fear of its undergoing change from decomposition.

Needle Embalming.

Since the publication of the directions given above, and which some may still think describe the best mode of embalmment, a radical change has been made in the process, a change

introducing by far the most practical, the most simple, and in every sense the best method. I call this the needle process because it brings into use no instrument of a cutting kind except a hollow needle of the same kind as for hypodermic injection, but of a rather larger size than that which is commonly employed. This new plan is advanced by the experiment, described in another place, of injecting the vascular system by and through the cerebro-spinal cavity. It appeared from the results of that experiment that the dead body might be injected over the whole of its surfaces by the needle without making any incision with the scalpel. The needle method reduces the art of embalming to a process of the simplest order, one less objectionable to the operator than conducting an autopsy; and, it leaves no mark or sign of injury whatsoever.

Details of the Needle Process.

The solution used is not widely different from that named on page 620. For embalming a body of the weight of one hundred pounds, the following solution is required:

Zinc chloride,	500 grains.
Methylated spirit,	3 pints.
Dissolve, and add in solution:	
Ethylic alcohol (sp. gr. 0.830),	1 pint.
Chloroform,	½ pint.
Benzoic acid,	120 grains.

This solution should be prepared beforehand, and may either be put into the injecting bottle already described, or carried in a wide-mouthed vessel, from which an injecting syringe can easily be charged.

For the purpose of injecting a series of hollow needles is required. The longest needle should be six inches in length, the shortest three, and it is well to have one of intermediate size. The needle in use should be attached to a strong india-rubber tube a sixth of an inch in diameter, and connected at its other end with the injecting syringe. The syringe should be capable of holding five fluidounces, and should be in good working order. If it has a double valve, so that it can be filled by the exhaust pull from an extra tube and discharged

through the needle by the down-push, after the manner of the ingenious syringe invented by Dupaul, so much the better; but really any good syringe will answer.

The syringe being charged, the operator commences to inject the cranial cavity. To do this he passes the long hollow needle through the conjunctiva at the inner canthus of the eyeball, and, directing it almost straight backward, carries it into the cranial cavity. An assistant then gently injects the preservative fluid, using no force and taking abundant time. He will thus be able to introduce four syringefuls into the cranial cavity without difficulty. This effected, the needle is withdrawn carefully, is introduced into the opposite side of the cranium, in the same manner, by the inner canthus of the other eyeball, and four syringefuls more of fluid are also injected, after which the needle is again withdrawn. Two pints of the preservative solution have now been thrown in, and have been carried by the veins all over the tissues, a fact that will often be shown by the veins of the hands or of the lower limbs becoming distended.

Two syringefuls—five fluidounces—of the preservative fluid are next to be injected into the right cavity of the thorax through one of the intercostal spaces, the same quantity into the left thoracic cavity, and the same into the left cavity of the heart, which can easily be reached by insertion of the long needle. The abdomen, relieved of gaseous substance, after the manner related in the preceding section, is next made to receive into its cavity the fourth pint of the solution. Finally, with a smaller needle the last remaining pint of the solution is subcutaneously injected, in the proportion of three ounces for each upper extremity at different points, four ounces for each lower extremity at different points, and the last six ounces over various parts of the trunk of the body. As a general rule, the proportions of fluid specified are quite sufficient for an adult subject, the quantities being reduced or increased according to weight; but there is no harm done by subcutaneously injecting another pint of the preservative or by throwing a pint more of it into the abdomen or into the cavities of the chest or heart.

When these injections have been neatly made, not a trace of mark or of disfigurement is left, and the whole process may be completed in an hour. Afterward the body is very care-

fully swathed in a series of bandages saturated with the following solution:

Pure tannin, ...	250 grains.
Ethylic alcohol (sp. gr. 0.830), .	10 fl. oz.
Collodion, ...	9 fl. oz.
Balsam of tolu, ...	1 fl. oz.
Gum benzoin, until it ceases readily to dissolve.	

This makes a solution of the consistency of glycerin, which is adhesive, is readily absorbed by the substance of the bandage, and gives out a fragrant odor.

The best substance for the bandage is that kind of porous flannel used for lining dresses and called *domette.* The bandage should be about three inches wide, used in lengths of six yards each, and should be firmly and very evenly applied. The body, duly arranged by the attendants, should then be laid at once in the casket that is to receive it; and if it has to be sent away a long distance, it should be closed up entirely from the air, after two fluidounces of benzoated chloroform (described at p. 638 of this number) have been sprinkled or sprayed over the garments in which it is enshrouded, and after it has been covered with some soft pillow substance or blanket, in order to save it from mechanical injury incident to movement during voyage or travel.

Condition of the Body to be Embalmed.

The condition in which the body exists before it is embalmed makes a material difference in the success of the process. In some instances it is essential to open the cavities of the body, although a post-mortem may not be demanded. If in any of the cavities there be a large vascular tumor, or a cyst, or a great enlargement of some particular organ, it may be necessary to remove such diseased part, or to empty it. In a case of empyema, or hydrothorax, or ascites it is requisite to empty out the exuded fluid; in the case of a large cancerous tumor in the abdomen, or of an enlarged liver, it is necessary to remove the structure altogether. Such structures may afterward be divided into portions, saturated with the preservative solution, and returned into the body.

The most difficult subjects to embalm are those who have

died with general anasarca. In these cases it is exceedingly troublesome to inject a free current of the preservative fluid. It is also difficult, where there is anasarca, to determine how much preserving fluid will be required in order to sustain the necessary preservation; but the needle process renders these difficulties much less formidable than they were.

As a rule, the best period for embalmment is about twenty-four hours after death, unless there be circumstances present which are leading to a rapid decomposition. At the end of twenty-four hours the rigor mortis has passed away, and the process of injection is readily carried out.

The fact of commencing decomposition is no actual obstacle to the process of embalming, though it is decidedly objectionable. The parts that have become discolored by the putrefactive changes are often restored in a remarkable manner to their natural color when the injecting solution has fully permeated them. All the impure odors that arise from putrefaction are removed by the embalming, and all further putrefactive change is effectively prevented.

Allen's Surgical Pump as a New Instrument for use in Embalming.

This instrument consists of a metal cylinder, upon the inner surface of which is coiled a single loop of rubber tubing, turned in the centre of a piece a yard or more in length.

A shaft having a suitable crank passes through the cylinder, to which is attached a roller provided with springs so arranged that any degree of pressure desired can be made by it on the tubing (see Fig. 1). By properly adjusting the springs each revolution of the crank will displace as much air or liquid as is contained in that portion of the rubber tubing forming the loop. As the roller in passing around the circle must rest on the tubing, completely closing it at some point, there is no necessity for any valves, and if one end of the tubing be attached to a vacuum bottle and the crank be turned so as to force the air in the tubing in the opposite direction, a powerful vacuum will soon be formed, and a good aspirator supplied; or if the same end be attached to an air receiver and the crank turned toward it, a high pressure of condensed air will be obtained. This apparatus is adapted for pumping

both gases and liquids and is either a force or vacuum pump, depending only on the direction in which the crank is turned. It has no valves or stopcocks, and the current may be instantly reversed. It has sufficient power to force a column of

FIG. 1.—Showing the Rubber Tube coiled within the Cylinder.

water to a height of one hundred and sixty feet, maintaining it at that height, and the next to the smallest size will easily pump one quart of liquid per minute.

This injecting apparatus is now used in America for embalming, and is without doubt a perfect exhaust or forcing syringe for this, as for other purposes. In order to empty the cavities of the body of fluids or gases, the inventor has added

FIG. 2.—Showing Aspiratory Attachment.

what he calls an embalming trocar, in describing which he explains that in order to convert the syringe into an embalming instrument it is furnished with a pointed evacuating tube (see Fig. 3); and as this pump works with much greater force

than any other evacuating isntrument, there is much less danger of the tube becoming clogged. Moreover, should clogging occur, the operator has only to give the crank one or two turns in the opposite direction to free it at once.

FIG. 3.—Embalming Trocar.

The syringe can be affixed firmly to the upper rail of the back of a chair. To the syringe other tubes can also be attached for injecting the arteries (see Fig. 4), or for that pro-

FIG. 4.

cess of needle embalming which has now for the first time been described, and which is the latest development of one of the most ancient arts.

CHAPTER V.

EMBALMING WITH A POST-MORTEM EXAMINATION.

It occasionally happens that a body which is to be embalmed requires to be subjected to a scientific examination in order to determine the cause of death. Under such circumstances the process of embalming is more complicated than has been described in the former parts of this essay; but if the operator who is to embalm may himself make the post-mortem inquiry, the difficulties that are added need not be very great.

In conducting the post-mortem the incision along the body must be made in one straight line only: the two lateral incisions usually made beneath the diaphragm are to be omitted. The skin must then be very neatly reflected from the chest, without cutting through muscular fibre; the cartilages of the ribs must be divided with evenness and regularity, and the division must not extend quite so high upward as the sterno-cleido articulation. When the incision through cartilage has been carried on each side up to the point named, the sternum is to be carefully divided transversely, and the anterior part of the chest-wall that has thus been separated is to be removed altogether.

The thoracic viscera having been exposed, the viscera of the abdomen are to be laid open by a straight incision, in the line of the linea alba, through the peritoneum. The diaphragm should be left in position and without injury.

The examination of the viscera may now proceed as usual, after which all the viscera that are to be left in the body should be freely saturated by needle injection with the zinc chloride solution; and the intestinal tube, tied at its upper and lower part, should be saturated with the solution.

If it be necessary to make an examination of the contents of the cranium that must next be proceeded with in the usual way, but with more than usual care. The skull must be cut

through with a fine saw, and the line of the incision made by the saw must be exceedingly regular.

If the brain, after examination, be returned, it must also be treated freely with the preserving solution.

Next, the surfaces of all the visceral cavities are to be painted over with the preservative, and the organs are to be returned to their respective cavities. If there are no organs to be put back, the cavities should not be left empty, but should be filled with gypsum, to which has been added a quarter part, by measure, of tannin and a little gum benzoin or myrrh to give a fragrant odor.

To replace firmly and neatly the anterior part of the chest-wall and to retain the separate parts in a fixed state, it is requisite to bring the ends of the divided ribs carefully into apposition, and to bind them with iron or silver wire. It is good to use for this purpose a small archimedean drill, in order to bore a hole through the bone on each side, to pass a loop of wire through, and with pliers twist the ends of the wire firmly, cutting them off not too closely. To fix the calvarium five wires are required, two for the parietal part, one for the centre of the occiput, and two intermediate. No wire need be inserted in the frontal space.

The divided integuments of the abdomen and head are to be brought neatly together with thread or silk by the close small suture.

After the whole of the divided parts are completely closed, the process of subcutaneous injection with the zinc solution must be carried out precisely as directed in the preceding essay, except that more fluid must be thrown into the cellular tissue. The injection of three pints of the zinc solution into the cellular structure is not too much, and it can easily be introduced by injecting it in small quantities at many points of the surface of the trunk and limbs. Finally, the swathing of the body in the bandage saturated with the tannin and benzoin solution will complete the process.

This modified mode of embalming with a post-mortem can be made exceedingly perfect. It may indeed be made as perfect as if there had been no post-mortem; but it calls for more time and requires more care.

CHAPTER VI.

ON CERTAIN PRESERVATIVE FLUIDS.

BEFORE I conclude this subject of embalming, I would like to add a few pages of description on the art of preserving museum and laboratory specimens in preservative fluids. For such specimens, fluid preservatives are mainly useful. In the museum and laboratory the use of wine spirit—ethylic alcohol—has long held the first place, but of late years methylated alcohol has been commonly used, owing to its cheapness. These alcohols preserve perfectly, but they are expensive, and they always bleach and destroy the flexibility of the structure that is immersed in them. Some other fluids, therefore, come in well for general use. I will give a few of the best.

Ammonia Solution.—Strong liquid ammonia (sp. gr. 0.882) is always useful as a preservative. Twenty to thirty minims diffused in a pint jar well closed will preserve anatomical parts for many years. Ammonia is the readiest and one of the best vaporizable fluid preservatives known.

Bichromate Solution.—Mr. Savory, who always makes some useful addition to our knowledge on the rare—I regret to say too rare—occasions on which he speaks, described more than twenty-five years since the then new fact that bichromate of potassa is an admirable preservative when used in solution. The solution is made as follows:

Potassa bichromate, . . .	3 grains.
Water (distilled), . . .	1 fluidounce.

This solution preserves and does not harden the structure. It rather destroys color, causing a change toward a greenish tint. To prevent this, the following modification may be adopted:

Potassa bichromate, . . .	3 grains.
Potassa nitrate, ...	2 grains.
Water (distilled), . . .	1 fluidounce.

Both solutions keep very well, and in using them nothing more is necessary than to suspend the specimen to be preserved in a preserving jar, and afterward add the solution.

Zinc Colloid.—Zinc colloid is a fluid I have myself introduced, and it is useful where it is necessary to preserve and at the same time fix or harden a tissue. The preparation is made as follows:

Tannin, ...	10 grains.
Alcohol (sp. gr. 0.830), . .	4 fluidrachms.
Tincture of benzoin, . .	1 drachm.
Collodion, ...	8 drachms.
Zinc chloride, . . .	5 grains.

Dissolve the tannin first in the spirit; add the benzoin and the collodion, and finally drop in the zinc chloride in very small pieces and slowly, until a complete solution of it is secured. This preparation is laid on to the structure with a brush. Very little of it is required.

Carbolic Colloid.—Another preparation in the colloid form is made as above, but instead of zinc chloride, carbolic acid is introduced, in the proportion of three to five grains to an ounce. This solution, laid on with a brush, preserves membranous structures very efficiently for a long time, but it is less permanent than the zinc colloid.

Diffusible Creasoted Fluid.—For spongy textures, and for fur, feathers, or hair, creasote answers admirably if it be neatly applied. For this purpose the following solution is good:

Pure beechwood creasote, .	10 minims.
Amyl hydride (sp. gr. 0.620), .	1 fluidounce.

Let the creasote dissolve in the hydride; stop the bottle well and keep in a cold place.

In using this solution, it is only necessary to pour a little of it on the specimen to be preserved, and then gently blow with the warm breath over the part were the solution has been laid. The light amyl hydride, which boils at 88° Fahr., will all evaporate instantly, and will leave the creasote in a state of the finest subdivision, on the structure.

Diffusible Iodine Fluid.—Sometimes a substance about to be examined has become somewhat tainted already, and

requires to be deodorized. For this purpose, the fluid called above diffusible iodine is useful. Its composition is:

Iodine, ...	5 grains.
Amyl hydride (sp. gr. 0.620), .	1 fluidounce.

Let the iodine dissolve, close the bottle firmly, and keep in a cool place.

In using this solution, pour a little on the specimen and blow gently to evaporate the hydride. The iodine will be left in a state of fine subdivision, and will quickly deodorize.

Diffusible Bromine Solution.—

Bromine, ...	5 minims.
Amyl hydride, ...	1 fluidounce.

Let the bromine mix with the hydride, stop the bottle closely, and apply as above directed for the use of the iodine solution. This bromine solution is very effective, but is not quite so manageable as the iodine. It affects the breathing if inhaled as vapor.

Mem.—The last-named two solutions are applicable for many other purposes. They are splendid disinfectants as well as deodorizers, but they require to be used with care in the presence of a light, the vapor of the amyl hydride being very inflammable. Amyl hydride is sometimes sold under the name of rhigolene.

Diffusible Benzoin Solution.—For the same class of specimens, I mean where there is a taint or odor of decomposition, it may be wished to use a deodorizer which yields an agreeable odor. For that purpose, the following answers well:

Benzoic acid, ...	5 grains.
Alcohol (sp. gr. 0.830), . .	2 fluidrachms.
Amyl hydride (sp. gr. 0.620), .	1 fluidounce.

Let the acid dissolve, close the bottle carefully, and keep in a cool place. The solution is used in the same manner as with the two immediately preceding.

Benzoated Chloroform.—This solution was described in the last "Asclepiad." The composition is:

Benzoic acid, ...	3 drachms.
Chloroform, ...	12 fluidounces.

Let the benzoic acid dissolve in the chloroform. If there is

any residue, filter, and the solution is ready for use. This is a most useful solution. It is good for deodorizing the hands after a post-mortem; for the temporary preservation of parts and organs; and even for the temporary preservation of the whole body, a little of it being spread or sprayed over the body to be preserved before inclosing in an air-tight shell or case.

Strong Iodine Deodorizing Solution.—In some cases a specimen is so thoroughly decomposed, it is quite impossible to examine it until it is deodorized. Such a specimen may be rendered free of odor and firm, by being treated with the solution described below:

Iodine,	5 grains.
Alcohol (sp. gr. 0.830),	1 ounce.
Sulphuric acid (strong),	5 minims.

Dissolve the iodine in the spirit, and add the acid slowly. This solution should be made fresh each time for use, and the specimen should be just covered with it and left in it for a few hours. The specimen will be rendered free of odor of putrefaction, firm, and preserved. Covered afterward with spirit simply, it will lose much of its dark color, and re-assume a very natural appearance.

Solution for Arsenical Washing (Tranehini's).—For a preservative arsenical solution, Tranehini's is most ready:

Arsenious acid,	3 grains.
Cinnabar,	1 grain.
Alcohol (sp. gr. 0.830),	1 fluidounce.

Mix, and frequently agitate the solution. This solution is useful for preserving skins of animals. It has been used also for embalming.

Preserving and Bleaching Solution.—A specimen naturally white in structure may become changed of a dark color and be decomposing. To preserve such a specimen, there is no solution so good as the following:

Alcohol (sp. gr. 0.830),	10 fluidounces.
Sulphurous acid,	to saturation.

Put the alcohol in a flask, surround the flask with ice water, and then pass *sulphurous acid gas*, made by the action of strong sulphuric acid on copper turnings, through the alcohol,

until bubbles begin to escape freely. After this, take away the gas and close the flask containing the saturated alcohol securely.

This is a most useful solution to have at hand. A very little of it, applied to a specimen, deodorizes, bleaches, and preserves.

Corrosive Preserving Solution.—

Mercury bichloride (corrosive sublimate), 10 grains.
Alcohol (sp. gr. 0.830), . . . 1 fluidounce.
Acid hydrochloric (sp. gr. 1.16), . 10 minims.

This solution is useful for the preservation and hardening of delicate soft structures, such as the brain and spinal cord. The most perfect specimens of preserved brain I have ever seen have been preserved with this solution.

Glycerin Zinc Solution.—For preserving the brain in part or entire, or other nervous structures, the following also answers well:

Methylated spirit, . . . 20 fluidounces.
Zinc chloride, ... 30 grains.
Glycerin, ... 10 fluidounces.

Dissolve the zinc chloride in the spirit and gradually add the glycerin. In use immerse the structure in the solution, and keep it in until it is fully saturated. Then remove and let harden.

Pacini's Solutions for Minute Structures.—Professor Pacini employs the following solutions:

	I.	II.	III.	IV.
Corrosive sublimate, . .	1	1	1	1
Chloride of sodium, . .	2	2	1	0
Distilled water, . . .	100	200	300	300

	V.	VI.	VII.
Corrosive sublimate, . . .	1	1	1
Acetic acid, ...	1	3	5
Distilled water, ...	300	300	300

	VIII.
Corrosive sublimate, ...	1
Phosphoric acid, ...	1
Distilled water, ...	300

No. I. he uses for all vascular tissues of the human body,

or of warm-blooded animals, such as pieces of a hyperæmic peritoneum, villi of the placenta, etc.

No. II. for the corresponding tissues of cold-blooded animals.

No. III. for cells, pus, infusoria, spores.

No. IV. is to be substituted for No. I. in all cases where the blood-globules, which are so easily destroyed by chloride of sodium, are to be preserved intact.

No. V. is sometimes preferable to No. III., the acetic acid rendering the nuclei more distinct.

No. VI. is to be used for all fibrous tissues, muscles, and nerves.

No. VII. for glands; and

No. VIII. for cartilages.

Conclusion.

With these final memoranda I bring to a close this work on the science and art of embalming. I could have added some other, as yet fanciful, methods, but am content, for the moment, with supplying what is immediately practical, derived from many years of observation, and based on forty-eight actual embalmments. By a careful perusal of the instructions given, every medical men may now carry out the details of the art himself with perfect confidence and success; a result which, I hope, will be useful to the younger members of my profession specially, whose interests I sincerely cherish.

THE ETIOLOGY, DIAGNOSIS AND TREATMENT

OF

TUBERCULOSIS

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THE ETIOLOGY, DIAGNOSIS AND TREATMENT

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TUBERCULOSIS.

CHAPTER I.

THE ETIOLOGY OF TUBERCULOSIS.

THE fundamental revolution experienced by the doctrine of the nature of tuberculosis as the result of Koch's classical investigations, has also had a reforming influence on clinical views. So long as the nature of the disease was unknown, the theory was compelled to move in various directions according to the prevailing opinions. Thus, tubercle was regarded as a new formation, as a specific infectious structure, or as the product of inflammation. Its development from bronchial catarrh, pulmonary hemorrhage, pneumonia, inhalation of dust, was maintained as often as it was combated. Infectiousness was also attributed to tuberculosis at certain times, at other times it was denied. Heredity alone was regarded in all times as an incontrovertible, certain etiological factor. And now even this has been subjected to the sting of doubt.

Into this maze of theory and empiricism, Koch's discovery has suddenly thrown a brilliant light, which not alone cleared up the essential feature of the question, but has also proved stimulating in all directions. With one blow the old, much-disputed question of the nature of tuberculosis was solved, and the parasitic nature of the disease as well as of scrofulosis in all its forms and localizations was settled.

I remember the deep impression made upon me and upon the other members of the Pharmacopœia-Commission by Koch's first demonstration in the laboratory of the Imperial Sanitary Bureau. Koch had previously allowed nothing concerning his discovery to reach the public, and he yielded only to our wishes and to those of Dr. Struck, then Chairman of

the Sanitary Bureau, in demonstrating his preparations and describing the manner in which he had arrived at the discovery of the tubercle bacillus. In the modest labor of this diffident scholar we saw revealed one of the greatest problems in pathology, the nature of the severest scourge of the human race. And how complete and reliable the solution of the problem was, was only shown when criticism and later investigations not alone failed to produce any material change, but even to add anything of a material character. Each chain in the long link of the discovered facts was found as durable as the whole.

Clinical medicine at once accepted Koch's new doctrine, and has conscientiously devoted itself to the reformation of opinion presented by the bacillary theory. That many difficulties would be encountered at the start, was evident to every judicious mind. Indeed, the comprehension of certain questions in the doctrine of tuberculosis from the standpoint of the bacillus theory seemed to stumble upon inconquerable difficulties, and this was true in the main of the question of heredity.

There is perhaps no fact of experience which was regarded as so incontrovertible as the heredity of tuberculosis. Every day the physician sees tuberculosis reap its harvest among the progeny of a tuberculous father or a phthisical mother. He sees the children of such parents grow up scrofulous in childhood, and perish tuberculous in youth.

How could this axiom of experience be made to harmonize with Koch's bacillus theory?

This was attempted in various ways. But the majority of previous explanations are mere hypotheses, for which, on the whole, no proof can be adduced, although there may be individual affirmative facts.

The transmission of tuberculosis by the father is explained by the conceptional introduction of bacillus-containing spermatozoa, although this assumption is based on nothing beyond the demonstration of bacilli in the testicles of tubercular men. For the conceptional transmission by the mother we would have to assume bacillary infection of the ovulum, either *ab initio* or by emigration. Subsequent intra-uterine infection of the fœtus by the paternal semen or maternal blood is also within the range of possibility. But these hypotheses are *dernier ressorts*, and the absence of direct proof of the hered-

ity of tuberculosis has evidently stimulated the search for an explanation of hereditary tuberculosis in other ways. The views of Sée in his work on bacillary tuberculosis and those expressed by Ruehle in his address at the Sixth Congress for Internal Medicine and in his treatise on tuberculosis (in my "Handbook of Special Pathology and Therapeutics") must be regarded as important attempts to replace conceptional and intra-uterine infection by post-fœtal, extra-uterine infections. That this deserves the greatest attention is evident from the consideration that much more can be done to free the human race from tuberculosis if heredity, which is influenced with such great difficulty, is replaced by extra-uterine infection, which it seems much easier to study and to check.

In fact, there are many evident methods for the infection of children. The intimate contact of the nursling with a sick mother or nurse, the kisses of a tuberculous father, the infection of the child's food with tubercle bacilli, the bacillary infection of wounds—all these are means of infection against which the helpless infant is so much less resistant the weaker its organism.

Infection by milk containing bacilli or spores is probably the most direct method next to direct infection by diseased relatives. On account of the frequency of the "pearl disease" in cattle this danger is very great, because the infectiousness of the milk is very marked, especially if it comes unmixed from a diseased cow or if the udder itself is tuberculous. The recent feeding experiments of Bollinger and his pupils, have disclosed the noteworthy fact that the milk of cows suffering from pearl disease will infect guinea-pigs, even if the udder is entirely normal and the animal, which is affected by pulmonary and pleural tuberculosis, is in an excellent condition of nutrition. The customary mixture of the milk of diseased animals with that of healthy ones undoubtedly diminishes the infectiousness very materially, and boiling for five minutes destroys the danger entirely, but people usually act with great indolence against such an obscure danger. Even in cultured families too little importance is attached to the source of the milk given to infants, and even the boiling of the milk is not conducted with that care and persistency which the subject demands. If the mother leaves the boiling of the milk to the cook, she may be quite sure that it will be done imperfectly.

I, therefore, advise you to recommend to mothers that they themselves prepare the milk for the children. This is best done by means of Soxhlet's bottles, by which all parasitic or chemical injury to the child is prevented, provided that the mother looks after the cleansing of the apparatus.

But as the matter stands at present, we cannot tell to what extent this danger of tuberculosis from the food really exists. It is possible that the fear of bacilli and spores in the milk is very much exaggerated, but the frequency of tuberculosis of the mesenteric glands in children always points toward infection by food, and since the infectiousness of the milk of cows suffering from the pearl sickness has been proven and nothing can be said against the application of these results to human beings, it is the duty of the physician to call the attention of his patients to the great danger.

There are many other means of extra-uterine infection which may simulate hereditary transmission, within a family whose close relations offer numerous possibilities for the exercise of an injurious influence on the children by a tuberculous father or mother. Soiling of the rooms, furniture, utensils, or food with bacillus-containing sputum, will lead so much more readily to infection of the, as it seems, susceptible children, the smaller the dwelling, the larger the family, the less the comfort and cleanliness.

But however plausible these means of tuberculous infection may appear from a theoretical standpoint, their influence must be regarded as not very great from the standpoint of practical experience. This is shown by the results of statistics and the daily experience of the practising physician. The transmission of tuberculosis from the patient to other persons living with him, especially to the husband or wife, to attendants and servants, is so remarkably rare, that the direct infectiousness of tuberculosis from one individual to another cannot be so great as is held theoretically by some.

We must, therefore, still cling to heredity as the explanation of the enormous frequency of tuberculosis in the children of tuberculous parents, and must await the explanation of the many obscure points in the question of heredity from the further development of our science.

A special difficulty in the question of heredity resides in the long latency of tuberculosis in childhood. If congenital

tuberculosis acted like syphilis or small-pox, *i.e.*, if the fœtus was born with the symptoms of the disease, the question could be easily decided. But tuberculosis is not manifest in the new-born. It acts like those rare cases of late congenital syphilis whose symptoms often do not appear until the second decennium, and whose nature—whether dependent on congenital or post-fœtal infection—is still a matter of controversy.

That tuberculosis is often present and perhaps has existed for years, although the child is regarded as perfectly healthy, is proven not infrequently by accident. The examination of a single swollen gland, which has been removed as a matter of precaution from a child who appears otherwise in blooming health, shows giant cells with bacteria in their interior. How long have these been present in the body? And further, are there other foci of infection in the glands? Who can answer?

Another circumstance deserves mention. During the last great epidemic of measles in Munich, Bollinger had repeated opportunity, as I gather from an oral communication, of demonstrating tubercle bacilli in the lymphatic glands, especially of the root of the lung and mediastinum, in the bodies of children dead from measles, although they were said to have been healthy previously and not to have been scrofulous. This important finding throws an entirely new light on the fact of experience that children are attacked so often by tuberculosis after measles. The infection with measles has not excited tuberculosis, but has only made the latent tuberculosis manifest.

The majority of cases of tuberculosis in youth are probably preceded by latent tuberculosis of the glands, which has lasted for years, as is so often shown in regard to scrofulosis of childhood.

But this does not prove that infection occurred at conception or during fœtal life. It is possible that the invasion of bacilli occurred during the first or second year of life as the result of a slight wound (which is rendered probable by certain observations), or by milk containing bacilli or spores, etc.

But, finally, we always return to the conclusion that these possibilities hold good almost solely in children born of parents who are tuberculous or present latent tuberculosis. Experience decidedly forces us to assume that the perfectly healthy human organism is extremely resistant against the permanent

colonization of the bacilli, and that their efficient reception in the lungs, intestines, etc., only occurs when certain conditions are present which favor their colonization and proliferation. This unknown pathological something we call predisposition to tuberculosis, applying this term to a certain constitution of the tissues of the organism which furnishes a favorable soil for the reception of the germs. We cannot do without this predisposition, which may be acquired as well as congenital. It exists with regard to other infectious diseases, such as typhoid fever, cholera, dysentery, etc.; why should we not also assume a predisposition for the reception of the tubercle bacillus?

Wherein consists this predispostiion which, next to heredity, plays the greatest part in the doctrine of the etiology of tuberculosis? We do not know. We know, in a general way, the appearance of an individual suffering from such an hereditary taint, and likewise the causal factors which produce the predisposition, but what its nature is, and what the morphological, chemical, or physical changes to which it owes its development, are entirely unknown.

In many cases, likewise, little weight can be attached to the outward appearances of the inherited predisposition to the so-called phthisical habit. The slim body, flat chest, thin limbs, delicate complexion, the vulnerability of the vessels of the mucous membranes, the tendency to epistaxis and catarrhal inflammations of the larynx, the frequency of palpitations of the heart, congestions, circumscribed redness of the cheeks, etc.—all these are very pronounced in many cases, but in some very little or nothing is noticed. How many robust young people become tuberculous on account of the family taint, despite their robust figure, firm muscles, healthy complexion, etc. Here a good deal still remains to be investigated.

The acquisition of the acquired predisposition is favored by all those depressing influences which our life carries with it in such great measure: insufficient food, unhealthy habitation and mode of life, insufficient sleep and fresh air, worry and cares, nursing and night watching, bodily and mental overexertion, previous diseases, parturition, etc.

Of all these factors which impair the resisting power of the tissues and cells, none has such an important influence as the want of sufficient muscular action out-of-doors and of sufficient fresh air.

We can study this most accurately in the inmates of prisons, houses of detention, cloisters, etc. The restriction of freedom and of the free enjoyment of fresh air contains a series of factors, whose efficiency is estimated with difficulty in detail. The following points are especially to be considered: the air in the closed rooms, especially in the dormitories, is not pure; it contains dust and fungi, and is poorer in oxygen, richer in carbonic acid and odoriferous particles. On account of the sedentary habits the respirations are not sufficiently deep, the lungs are expanded imperfectly; the nutritive changes are diminished on account of the absence of motion in the open air and vigorous muscular work, the need for nourishment is therefore less, and moreover, the appetizing quality of the food suffers from the monotony of the bill of fare. The preparation and quality of the food are probably imperfect in many cases. In prisons, moreover, there are the psychical factors of remorse, yearning for liberty, family, etc., forced intercourse with the scum of humanity, loneliness in the cells, the absence of all excitement.

Here we find a series of depressing factors. The organism is in a condition of deprivation which opens wide the door for the reception of the tubercle bacillus, which is undoubtedly ubiquitous in prisons. It is generally known that phthisis is common in prisons, but the immense proportion of inmates of such institutions who fall victims to tuberculosis is probably known only imperfectly. The figures in Baer's article in the "Zeitschrift für Klin. Medicin" show a mortality from phthisis which is three to four times greater than that obtaining outside of prisons. The general mortality from phthisis is calculated at about 14 to 15% of the entire mortality, in prisons it is 40 to 50%, *i.e.*, about one-half the inmates die from tuberculosis. But the conditions differ appreciably in these institutions. For example, the mortality from phthisis in the prisons of Austria reached 61% during four years, while in the penal institutions of Bavaria the mortality was only 38.2% during eight years.

Moreover, the mortality in the different penal institutions appears to vary according to their construction and organization, at least we hear that tuberculosis is still more frequent (60% of the entire mortality) in those prisons in which the inmates are confined in cells.

It is a very striking fact that the mortality reaches its maximum in the later years of confinement. It is evident, therefore, that there is not merely a simple infection within closed apartments, which occurs as soon as the convict enters the prison, but that, in the majority of the cases, protracted impairment of the constitution is required before the organism is suited to the development of bacilli.

Many less resistant constitutions are affected at a very early period, especially if the change from country air to that of the prison has been very abrupt, as is seen so often in convicts from the country. This observation is confirmed by the statistics of French and English military surgeons, according to which the frequency of cases of disease and death from tuberculosis diminishes rapidly during war manœuvres and forced marches, while it increases considerably during peace, especially in winter barracks. The crowded factory population of large cities, who work by day in dusty, over-crowded work-rooms, and pass the nights crowded into narrow, dirty rooms, are subject to the same dangers.

The proportion of tubercular affections in factory operatives to those in country people also favors, in a very pronounced manner, the assumption that it is chiefly the quality and quantity of the inspired air which are decisive. In Switzerland, for example, the mortality from phthisis in the industrial classes is more than double that in the agricultural classes. In the industrial classes the average mortality is 2.55%, in the mixed population 1.7%, and in the purely agricultural classes, 1.1% (calculated with regard to 1,000 healthy individuals).

Finally, the statistics show with positiveness that the frequency of phthisis is in inverse proportion to the elevation of the locality, that in very elevated regions, for example, in the Mexican cities, Mexico, Puebla, Quito, Potosi, which have an elevation of 2,500 to 4,000 metres, tuberculosis is very rare, and does not appear among the working classes, despite the unfavorable influences of factory life and mining.

Among the properties of high latitudes, which act in diminishing phthisis at an elevation of 500 metres, but more distinctly at 1,000 metres, we may probably disregard the influence of rarefaction of air, because similar favorable conditions are also observed upon the sea and on the steppes.

The chief importance attaches to the rapid movement of the atmosphere and to its freedom from microbes capable of proliferation. The examinations of the air with regard to microbes, made by Miquel and Freudenreich in Switzerland, showed their complete absence at an elevation greater than 2,000 metres, and their almost complete absence at an elevation of 560 metres (Thun). Mareau and Miquel also found the air on the high seas and on certain sea coasts almost free from microbes. The results of bacteriological examination are thus entirely in accord with medical experience. The empirically observed relative immunity of elevated and ocean climates may also be aided by the other factors in these atmospheric influences, viz., the pressure of the air, rapidity of the winds, and amount of moisture, and in a certain degree also by the more vigorous pulmonary gymnastics, which are favored by the entire group of atmospheric-telluric influences.

We will again dwell on this question in the discussion on therapeutics, and now return to the social sources of tubercular infection. We have learned that prisons and poor barracks are sources of such infection. Convents, well-attended schools, seminaries, and orphan asylums act in a similar way as places of origin of tuberculosis unless compensation for remaining in the infected air is furnished by suitable hygienic arrangements, both as regards construction and employment, and by an abundant supply of fresh air and active out-door exercise. In this respect, it seems to me, convents are situated most unfavorably, being classed next to penal institutions, inasmuch as the large proportion of their inmates succumb to tuberculosis. Here also the life in small poorly-ventilated cells, the insufficient supply of fresh air, the complete absence of exercise and of movements which induce deep respirations, are the essential causes of the disease.

This is also true of orphan asylums, schools, and seminaries, in which the pupils are brought up in conventual seclusion, and participate to a very limited extent in exercise, particularly in out-door games.

That the figures are not higher in these institutions is owing to the fact that the restrictions are not too strict, but particularly to the fact that the young people do not remain there too long. Most organisms can withstand the evil effects of confinement in prisons for months and years without visible

injury; it is only after the impairment of the constitution has reached a certain degree that the tubercle bacilli exert their destructive activity. The statistics of prison diseases also show that the development of tuberculosis is often favored by inflammatory affections of the respiratory organs, especially by pneumonia, which do not resolve in the regular manner. But many of these inflammatory affections are undoubtedly the effects of the colonization of the bacilli and not predisposing factors for their entrance. In our hospitals we often have the opportunity of seeing such cases of pneumonia which, at the start, are entirely like genuine croupous pneumonia in all symptoms, but which can be recognized at once as tuberculous pneumonia by the presence of bacilli in the sputum.

Special importance as regards the question of the direct infectiousness from man to man attaches to the experience obtained in those hospitals in which many phthisical individuals are kept among the other patients or are placed in special wards. The figures showing tuberculosis among the other patients or the attendants and nurses are not greater than outside the hospitals. According to Williams' reports, the physicians, nurses, and officers of the Brompton Hospital for Consumption—the largest hospital for phthisis in the world—are not attacked more frequently by tuberculosis than are the inhabitants of populous cities, despite the bad ventilation and imperfect cleansing of the spit cups, etc. Only three to four cases of tuberculosis could be attributed to infection in the hospital. Too much importance, however, must not be attached to these figures, because we know that the attendants of large hospitals are changed very often and it is very rare that they serve for years. When this does happen, we at once find figures indicating greater infection.

The greatest amount of disease is found among religious orders for the care of the sick. Their members, in accordance with the strict rules of the order (with the exception of those which exercise ambulatory care), go very little in the open air, and, in addition, are exposed to all those factors which I have mentioned as predisposing to tuberculosis; exhausting daily work from early morning until late at night, frequent watching by night, moderate diet, abundant religious exercises and, finally, rare and too brief recreation in the open air and country. In view of such work it is not astonishing if the

organism suffers and offers a suitable soil for the bacilli. Among the Sisters of Charity of our large Munich hospitals, of whom one after another dies from phthisis at an early age —we may assume unreservedly that fifty per cent die of tuberculosis—we find that even without an hereditary predisposition, tuberculous infection occurs as a result of their activity in the hospital and strict compliance with the rules of the order. The young girls who enter the order as novices come almost without exception from the country, and have robust constitutions, are healthy and red-cheeked. In a few months, rarely not until the end of years, appears the unearthly pallor which is usually a forerunner of hæmoptysis. It would be absurd to suppose that all these healthy country girls possess an hereditary predisposition to tuberculosis, but despite their strong constitutions one after another falls a victim to phthisis with frightful regularity.

Do we require further proofs of the direct infectiousness of tuberculosis, of the dangers incurred by seclusion from fresh air and out-door exercise, by diminution of sleep, absence of rest and recreation during exhausting labors in the sick room? I will revert to this subject in discussing prophylactic treatment. It is so grave that I wish to impress it upon all who can help to improve these conditions.

Finally, as a proof of the direct transmission of tuberculosis to previously healthy individuals, we find cases of unintentional inoculation in which slight injuries, for example, the extraction of a tooth, a small incised wound, etc., have given rise to secondary swelling of adjacent lymphatic glands, and these, after extirpation, were found to contain giant cells with tubercle bacilli in the interior. It is true, however, that these cases are capable of more than one interpretation, because the bacilli may have dated from an earlier period and only have become demonstrable on account of the traumatic lymphadenitis. The clearness of the infection experiment may always be doubted so long as there is no certain criterion of the complete absence of bacilli from the lymphatic gland system prior to the inoculation. Such a criterion we can hardly hope to obtain.

We have now discussed all the essential factors which favor the colonization of tubercle bacilli in the human organism. It remains for us to give a brief description of our

knowledge of the mode of colonization, proliferation, and spread of the bacilli, and of the powers of resistance which the organism has at its disposal.

The digestive tract in children and the respiratory apparatus in adults, appear to be the ordinary paths by which the bacillus enters the body. But there are probably exceptions to this rule. In the intestinal and mesenteric gland tuberculosis of children, bacillus-containing food seems to be the primary factor; in pulmonary and bronchial gland tuberculosis the direct inhalation of the bacilli. In order that the bacilli may adhere to and proliferate in these parts, we must postulate pathological conditions of the tissues which furnish a suitable soil. The healthy organism rids itself of pathogenic micro-organisms which enter the various systems, probably by the activity of its secretory and excretory apparatus, and by inclosure in cells, in which manner, in all probability, their vitality is destroyed or at least impaired. If the normal organism did not possess such protective agencies, the maintenance of the integrity of the organs would be impossible on account of the ubiquity of so many pathogenic micro-organisms. The microbe of tuberculosis, in particular, would be deleterious to all individuals who remained for a longer or shorter time within their area, for example, in large wards for consumptives. And yet, as I have before said, the opposite is reported by Dr. Williams of the Brompton Hospital for Consumptives, where the fact has been statistically determined that tuberculosis is not more common among the physicians, attendants, and officers of the hospital than among the townspeople. It is only when the fatal predisposition is added to the opportunity for infection, *i.e.*, when, as we must assume, there is slight power of resistance of the cells against the foreign intruders, that the germ adheres and finds the conditions for its proliferation and spread.

I have said that the resistance of the body depends, so far as we know at present, upon the normal function of digestion, the secretion of the bronchial mucous membrane, and the vigorous activity of the amœboid cells.

That the normal gastric juice digests the bacteria introduced with the food, or at least makes them incapable of proliferation, may be accepted as proven. On the other hand, the most varied disturbances of gastric digestion, neutral or

alkaline reaction of the gastric juice, processes of fermentation and decomposition in the contents of the stomach, open wide the door for the unobstructed passage of the bacteria.

On account of the ubiquity of the bacilli, the greatest danger lies in the entrance of the bacteria into the air passages. To a certain extent we know the resistance of the organism against foreign bodies which enter with the inspired air from the examination of the sputum of such persons during life and of their lungs after death. The smallest foreign bodies, particles of dust, etc., are taken up by large cells, whose origin is not yet settled. In my opinion they are not all derived from the alveolar epithelium, but, as I shall explain later, are furnished probably by the cup cells of the bronchial mucous membrane, perhaps also by the subepithelial cell layer. In moderate grades of dust inhalation, for example, from remaining in rooms filled with tobacco smoke or the smoke of charcoal or coal, particularly in bakeries and smithies, we find in the sputum immense numbers of large round cells, which remove the particles of carbon inclosed in their parenchyma. On the other hand, in permanent dust inhalation, for example, in coal mines, mirror factories, etc., this cellular activity is by no means sufficient, but the dust is received into the epithelium of the alveoli and the lymph stomata, and is partly deposited in the interstitial tissue, partly carried through the lymphatics to the bronchial glands. The beautiful observations of Zenker and Merkel on the lungs of mirror polishers which have been impregnated with the dust of "English Red," furnish the most convincing pictures. Hence the resistance of the lungs, *i.e.*, their ability to eliminate foreign bodies, is limited though still very considerable. But it is very probable that the number of "dust-eating" cells and their activity in the ingestion of foreign bodies depends to a certain extent on the reaction of the bronchial mucous membrane and the alveolar walls, the emission of the cells, depends upon the activity of the ciliary movements and of expectoration. In the diminished energy and reaction of the lining cells of the air-passages consists an essential factor in the colonization of the bacilli. This view is favored by the absence of reaction at the beginning of tubercular infection, as Baer observed in convicts, and as we have noticed among the Sisters of Charity. The patients grow emaciated, anæmic, and feeble.

Neither cough, dyspnœa, nor other respiratory disturbances are present, yet physical examination reveals infiltration of one or both apices of the lungs. This absence of signs of reaction, it is true, characterizes only the higher grades of cellular weakness, such as occurs in prisons and convents, but from this extreme degree we may infer the slighter grades of diminished resistance.

I here desire to introduce a question of practical importance, *i.e.*, the predilection of the apices for the establishment of tuberculosis. That this exists need not be proven in view of our daily experience. It has been assumed hitherto that this colonization of the bacilli in the apices was owing to their imperfect inspiratory expansion, on account of which the ventilation of the bronchioles and alveoli of the apex was insufficient; this, in turn, leads to stagnation of secretions and inflammatory products. To this cause was attributed the frequency of apex tuberculosis in individuals whose calling entails sitting in a bent position, for example, in tailors, etc.

Hanau has recently expressed the view—and, as I believe, based it on good grounds—that the local predisposition of the apices of the lungs is due not to imperfect inspiration, but to impeded expiration. The vigorous inspiratory activity of the apices is clearly shown by the fact that they are favored in pneumonokonioses, both in those due to occupation and in Arnold's experiments on animals, in which the apices were always found to be affected earliest and most severely. Moreover, the bent position in man converts the physiological costo-abdominal type of respiration into an almost pure costal type, because the downward movement of the diaphragm is very much impeded by the narrowing of the abdominal cavity. In women the costal type predominates physiologically, so that in them there is no foundation *a priori* for assuming insufficient expansion of the apices.

But if the inspiration theory has no sufficient foundation, this is not true of Hanau's expiration theory. As Mendelssohn first deduced theoretically and as I have proven by observations on individuals whose thoracic muscles were absent, forced expiration is attended by a recurrent passage of air into the upper lobes, because the thorax lacks contracting muscular tissue at the level of the upper portions of the lungs. In coughing, therefore, the air will not alone stagnate

and be placed temporarily under high pressure, but the expectoration of foreign bodies and bacteria from the apices—and this is especially important with regard to the question under discussion—will be impeded by the recurrent stream of air, and the entrance of bronchial contents into the alveoli will be facilitated. The spiral course of the finest bronchioles in the apex may be an obstacle to the inspiratory aspiration of dust and bacilli as well as to expiratory expulsion. At all events this anatomical feature is in no sense favorable, but rather decidedly unfavorable, to the movement of inspired foreign bodies. I can, therefore, only agree with Hanau that the apices are relatively the most favorable sites for the inspiration of dust and micro-organisms, and the most unfavorable for their expulsion. When the tubercle bacilli have once entered this part of the lung, they experience a sort of rest which enables them to enter the lymph canals between the epithelium cells and to adhere to the subepithelial cell layer.

There is no doubt that, in addition to this inspiratory immigration of the bacilli, there may also be an invasion through the lymphatics and blood-vessels. In the lungs this can only be inferred from primary implication of the walls of the lymphatics and blood-vessels.

When the bacillus has entered the tissues, it gives rise to irritation and then to reactive inflammation, in consequence of its biological properties, which are not yet known. Then begins the struggle between the living cell and the parasite, which has been discussed so freely in recent times.

The struggle between bacteria and organic cells was regarded by Naegeli as that process in the infectious diseases upon whose outcome depend the life, sickness, and death of the individual. The vital energy of the cell, on the one hand, and the infectiousness of the bacterium, on the other hand, determine the result of this battle. If the cell is victorious, the bacterium is destroyed before it has had time to injure the organism. If the cell is conquered, there is no further obstruction to the proliferation and spread of the bacteria in the body.

This very general notion of Naegeli concerning the nature of infection and the part played by the living cell to repel it, has received a further development in Metschnikoff's phago-

cytes theory, which possesses much plausibility despite the ambiguity of the appearances observed by this writer.

According to Metschnikoff, the function of resistance inheres in the so-called glutton cells or phagocytes, which are recruited from leucocytes and fixed connective-tissue cells. They appear upon the battle-field with the irritation induced by the invasion of the bacilli. They proceed at once to devour the invaders, *i.e.*, they receive them into their parenchyma and digest them or make them incapable of proliferation. The phagocytes are divided into two groups, the large and small (makrophagi and mikrophagi). The former include the epithelioidal cells of the connective tissues, etc., the other the lobulated, nucleated leucocytes. Both forms, according to Metschnikoff, play different parts in different infectious diseases. According to his latest publication (Virch., "Archiv," Vol. 107, Part II.), the streptococci of erysipelas, for example, are swallowed by microphagi, these in turn are ingested by the parenchyma of the macrophagi and digested. Gonococci are also said to be eaten by microphagi, while the bacilli of anthrax in rabbits and guinea pigs are only ingested by macrophagi.

In tuberculosis, according to this writer, both forms of phagocytes take part in resisting the invasion. The macrophagi, as epithelioidal and giant cells, take a prominent part in the battle, but the microphagi also overcome large numbers of the intruders and begin the battle. Twenty hours after the inoculation of pure cultures of tubercle bacilli into the anterior chamber of the eye or beneath the skin of the rabbit, Metschnikoff found many microphagi stuffed with bacilli, *i.e.*, at a time when there could be no question of reaction on the part of fixed cells. It is not until later that the macrophagi take part, inasmuch as they swallow not alone single bacilli, but also microphagi which have been destroyed. In this way are developed characteristic conglomerates, in which are found entire heaps of ingested objects, by which the nucleus of the macrophagus is concealed, but is nevertheless demonstrable.

This doctrine has been vigorously attacked in various quarters. Its opponents acknowledge the reception of bacteria in the parenchyma of smaller and larger cells, but see in this not a tendency to recovery, but merely a mechanical intussusception of the bacilli, by means of which the latter gradually

undergo certain changes of shape. But according to Metschnikoff the protoplasm of the cells destroys the bacteria so that they gradually fall to pieces, or weakens their virulence until they become incapable of infection.

The interesting observations of Metschnikoff in his latest publications are of special interest in regard to one subject, and we look with suspense for the further communication which he promises on the tuberculosis question and for the discussion which will follow.

In accordance with the clinical conditions in tubercular infections, it might be assumed that the immigration of bacilli into a perfectly healthy organism is checked at once and made innocuous, that in a predisposed organism with enfeebled vital energy of the cells their virulence, while not entirely destroyed, is nevertheless rendered innocuous for the time by encapsulation in the fixed connective-tissue cells, but that when they enter feeble organs in large numbers they overcome all opposition and rapidly destroy the organism.

With regard to the latter point I call your attention to the possibility of an inundation of the air passages with bacilli-containing products of degeneration, which patients suffering from rapid softening in the lung may bring about by means of aspiration. Such an auto-infection of previously healthy portions of the lung furnishes a satisfactory explanation for the extensive tuberculous pneumonias which develop so often in the later stages of chronic tuberculosis.

Tuberculosis of the larynx, with hardly any exceptions, is secondary, *i.e.*, it follows primary pulmonary tuberculosis. Considered from the standpoint of inhalation-tuberculosis, the primary affection of the larynx cannot be regarded as impossible, but the epithelium seem to form a very firm barrier against the external enemy. Dr. Kukoff, who made an anatomical investigation of the subject in our Pathological Institute, and worked with the freezing microtome on the fresh larynges of phthisical patients, could never detect the entrance of tubercle bacilli from the outside, for example, from the sputum hanging in the larynx. He always found the epithelium intact and the bacilli penetrating from the subepithelial cellular layer into the intercellular juice channels of the epithelium toward the periphery.

Nevertheless there is no doubt that local infections from

the sputa bacilli may occur as soon as the smallest erosion has formed. However, this plays no part in the beginning of laryngeal tuberculosis. Here we must rely exclusively upon the current of blood and plasma in the laryngeal mucous membrane.

The question of the curability of laryngeal tuberculosis is now answered affirmatively in the sense of the above mentioned interpretation of the curability of pulmonary tuberculosis. Laryngeal ulcers of a tubercular character certainly do not heal often, but I am convinced of such a possibility. I have seen rapid recovery in several cases of tubercular laryngeal ulcers under the influence of a general standstill of the tubercular process, and after the death of the patients, which occurred some years after from repeated relapses of the tuberculosis, solid cicatrices were found. All experienced laryngologists must have observed similar cases.

You see from these remarks how many questions in the great field of tuberculous diseases still remain to be solved, before all the conditions of the life, activity, and death of the tubercle bacillus are so well known that it will become possible to destroy this hereditary foe of the human race. But you also recognize the enormous advances which have been made in the last six years in the doctrine of the etiology and pathology of tuberculosis, thanks to Koch's discovery. The enthusiasm with which the question is being further investigated and the strict methods employed, are guarantees of further steady progress, in which clinical medicine will take an active part.

CHAPTER II.

THE DIAGNOSIS OF TUBERCULOSIS.

It is not my purpose to-day to present the entire symptomatology and diagnosis of pulmonary tuberculosis; I would not alone come in conflict with the time at my disposal, but would also be forced to tell you many things that can be found more fully and arranged more systematically in any text-book. If you wish to study an exhaustive monograph on the present status of the tuberculosis question from a clinical standpoint, I can especially recommend to you the lucid description of this subject by Ruehle in the third edition of the "Encyclopædia" edited by me. This work, together with Sée's exhaustive monograph on bacillary tuberculosis, relieve me of the necessity of a detailed description of the subject, and enable me to concern myself to-day with a few of the more important practical points which are especially significant as regards diagnosis. Perhaps you will here find a few new standpoints which are of value to you in the judgment of individual cases and in formulating therapeutic indications.

I will first emphasize a few points in the symptom-complex which results from physical examination.

We will first consider the shape of the thorax in pulmonary tuberculosis.

The long flat thorax with its small antero-posterior diameter, creates the impression as if the arched chest-wall had sunken in or the vertical diameter had been enlarged at the expense of the sterno-vertebral diameter. This impression is strengthened by the thinness of the adipose layer and muscular tissue and by the slight inspiratory elevation of the chest. The term "paralytic thorax" describes this appearance very appropriately. The separation of the clavicles from the chest wall is caused in part by the emaciation of the soft parts, but only attains higher grades by the sinking in of the thorax

over the retracted apices of the lungs. The separation of the scapulæ also results from the thinness of the adipose tissue and the emaciation and atony of the muscles (trapezius, rhomboids, latissimus dorsi, serratus) and is found most distinctly when the back is "hollow," *i.e.*, when there is marked convexity of the upper dorsal vertebræ with compensatory lordosis of the lower dorsal and lumbar spine, as is found so often in a long thorax.

The flatness of the thorax and its small antero-posterior diameter are best recognized when the chest is looked at from the side, the arms being raised. Still more convincing are the figures obtained by means of Woillez's cyrtometer. After removal of the instrument the circumference of the chest is drawn upon the sheet, upon which the diameters had been previously indicated, after suitable fixation of the instrument. Such ideal sections of the thorax permit the differences in the shape of the healthy and paralytic thorax to appear most clearly. I here show you a few of these sections (in order to be printed they were, as a matter of course, made smaller by the pantograph and have thus lost the instructive character of the natural proportions). The sections were made through the spinous process of the ninth dorsal vertebra and the base of the xiphoid appendage, and in individuals between the ages of twenty-five and forty years. The woman, Fig. 1, and the man, Fig. 2, represent advanced phthisis. The normal thorax, Fig. 3, was obtained from a healthy, short butcher with vigorous muscles. In order to enable you to make a comparison with the increased size of the thorax which follows emphysema, I add, in Fig. 4, a section of an emphysematous patient, æt. 40 years, and which shows very well the differences in the size of the sterno-vertebral diameter. As a matter of course, the proportionate reduction in size is the same in all the cuts.

The emaciation of the chest walls causes the figures to appear somewhat more unfavorable to the paralytic thorax, but the difference produced in this way can hardly be estimated at more than 1.5 cm., because the cyrtometer was always screwed on tightly. The chief difference resides in the diminution of the antero-posterior diameter and its proportion to the transverse diameter. Absolute measurements of the sterno-vertebral diameter in healthy individuals possess no great value, because the dimensions of the thorax within the

limits of health are extremely variable. Nevertheless, it may be said that in men of average size (170 to 175 cm.) the antero-posterior diameter is not apt to diminish more than 20 cm.; in phthisical men does not sink below 18 cm.; in women it may even be reduced to 15 cm.

As Ruehle very aptly remarks, in very obese individuals who become tubercular, the paralytic thorax may be concealed at first sight by the thick layer of fat. But even in these

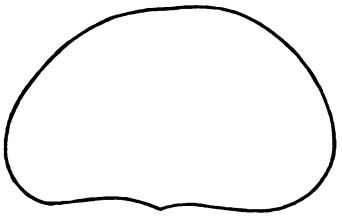

FIG. 1.—Phthisical Woman, aged 28 years. Narrowing of the left side.

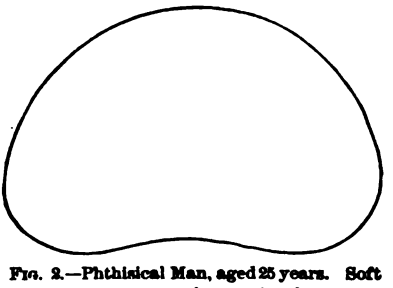

FIG. 2.—Phthisical Man, aged 25 years. Soft parts extremely emaciated.

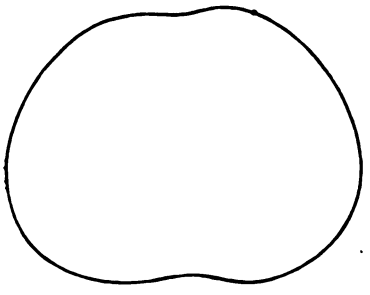

FIG. 3.—Normal Thorax, firm muscles, man aged 32 years.

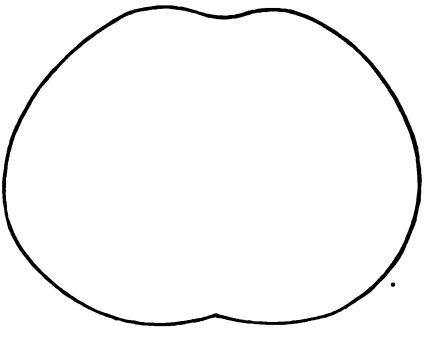

FIG. 4.—Ectatic Thorax in an Emphysematous man of 40 years.

cases the presence of this variety of thorax may be noticed on careful examination, especially when there is progressive emaciation.

There is no doubt that the paralytic thorax also occurs in perfectly healthy, tall, non-tuberculous individuals. In examining recruits, military surgeons have frequent opportunity of observing illustrations of this fact. Nevertheless this form of thorax is rare in healthy individuals and always arouses the **suspicion of a tubercular predisposition.**

It is evident that the greatest attention should be paid to the apices of the lungs in physical examination. As they are the site of the first deposit of bacilli in the large majority of cases, it is to be expected—and this expectation is completely justified by experience—that the first physical signs can be demonstrated in this locality. Moreover, the anatomical conditions for physical exploration of the apices are extremely favorable, because the apex proper is situated above the first rib, clavicle, and upper edge of the scapula, *i.e.*, it projects in a measure beyond the skeleton of the thorax. Hence arises the possibility of determining with great accuracy the upper limits of the apex and also the amount of air which it contains. The sharp definition of the air-containing apex from the larynx, neck muscles, and spine, presents no difficulty to one skilled in topographical percussion. Simple percussion with the finger gives approximately correct boundaries. If you wish to proceed very accurately you may employ the wedge pleximeter of ivory devised by me. This is constructed especially for boundary percussion and is excellently adapted to the definition of the apex. The instrument is shown in a side view of natural size in Fig. 5. The edge, which is two millimetres wide, is applied to the skin and percussion is made upon the upper surface, which is seventeen millimetres in width.

FIG. 5.

For physical reasons, the discussion of which would lead us too far, I recommend that percussion of the air-containing apices should always be performed from above, *i.e.*, pressing downward from the neck. The boundaries between the dull percussion note of the muscles and bones or the tympanitic note of the larynx and the percussion note of the apex should be marked with a colored pencil at the sharp border of the pleximeter. In this way we advance gradually from the front, *i.e.*, from the larynx to the spinal column.

When the boundaries are mapped out on both sides comparative percussion of both apices with regard to their air contents is performed. Percussion of the supra-clavicular regions must always be performed from behind, because the clavicles are in the way in percussion from the front and prevent the firm application of the finger in the supra-clavicular fossa. From

behind the finger can be applied firmly in the fossa. We thus compare the corresponding regions of the supra-clavicular fossa. It is well known that the external, middle, and inner thirds of this fossa furnish different sounds in health. The inner third gives the most intense, the outer third the least intense percussion sound. Hence care should be taken that in percussion of patients, only homologous regions are compared with one another. With equal care we then percuss and compare the supra-spinal regions and the portions of the thorax situated between them and the spine. The more firmly the finger is applied and the more uniformly percussion is performed with the middle finger of the right hand, the more reliable are the results, provided that homologous parts alone are compared with one another. The pleximeter is not used in percussion of the apex, because it does not fit into the supra-clavicular fossa, nor do I recommend the hammer, as its results are by no means so delicate as those of simple percussion with the finger.

The top of the apex of the lung shows a remarkable uniformity on the two sides in healthy lungs. The eyesight decides this most certainly and simply. If the level of the apex is to be expressed in figures, this is best done, in view of the peculiar configuration of the entire region, by measuring the distance of the top of the apex from the outer edge of the acromion along the edge of the trapezius, both arms being dependent. In healthy individuals, these figures exhibit a uniformity which is so much more remarkable because not only the configuration of the neck and upper part of the thorax, but also that of the scapulæ must be taken into consideration. Vertical measurements from the top of the apex to the clavicle are unreliable.

As a matter of course, the perfect equality in the height of both apices in healthy individuals renders any deviation from the normal very suspicious. Hence follows the great value of the comparative heights of the apices in the beginning of tuberculosis as well as in the later stages of the disease. In 1867, at the meeting of Naturalists in Frankfort, in the Section for Internal Medicine, I called attention, by photographs and demonstration on the living, to the great diagnostic importance of these measurements, and also believe that I then stated that their great importance was unrecognized by physicians.

But I must not fail to mention that Prof. Seitz (then in Giessen) had called attention in 1862, through one of his pupils, to the importance of percussion of the height of the apices.

As regards the clinical significance of a considerable difference in these levels, flattening of one or both apices is commonly found in resolution of smaller or larger infiltrations at the apex. The process of retraction, which causes this flattening of the apex, takes place in the young connective tissue that is the product of the reactive interstitial pneumonia. While the more or less extensive infiltration softens and degenerates, together with the alveolar tissue of the infiltrated lobuli, the young cicatricial tissue takes its place step by step. At first the tissue defect is usually quite considerable and is replaced, apart from the thickening of the pleura, by vicarious

Fig. 6. Fig. 7. Fig. 8.

dilatation of the adjacent air-containing pulmonary tissue. The height of the apex suffers most when the cicatrix is very extensive and ramified, and does not inclose any cavities of notable size. In general, therefore, a considerable flattening of the apex may be interpreted favorably, *i.e.*, in the sense of cicatrization and healing, particularly if the physical signs of cavity are absent. A few schematic figures will show this frequent process of natural recovery of tuberculosis of the apex. Fig. 6 represents the condition of infiltration, Fig. 7 the progressive softening and cicatrization with vicarious dilatation of the air-containing neighborhood, Fig. 8 the overlapping of the retracted cicatrix by the final supplementary emphysema of the adjacent parts.

In this last stage of simple cicatricial retraction and flattening of the apex, there is usually very slight dulness on percussion and exaggerated or diminished vesicular breathing with prolonged exaggerated or feebly bronchial expiration, *but without râles*, a sign that there is probably no progres-

sive process or open cavity which maintains softening and secretory processes. To a certain degree the flattening of the apex may be compensated at a later period by increased emphysema of the upper lobes which extends more and more above the cicatrix. This is especially apt to occur when the depressed upper portion of the thorax is gradually dilated by vigorous inspirations, as is observed in methodical pulmonary gymnastics after cicatrization of tuberculosis of the apex. The scaleni muscles are especially important factors in this process. Vicarious emphysema around the cicatrix and corresponding elevation of the apex must go hand in hand with the dilatation of the upper part of the thorax. Such compensation of former depression of the apex may be fol-

FIG. 9.

FIG. 10.

lowed clinically with tolerable accuracy. In my opinion this secondary emphysema in the vicinity of the cicatrix, which retracts toward the centre, may be regarded as a sort of protection against a new invasion of bacilli. It is a matter of experience that emphysematous lung tissue offers no good soil for bacilli cultures.

FIG. 11.

I will now show you a couple of photographs of individuals suffering from this flattening of the apex, taken after the boundaries of the apex had been percussed and marked with a pencil. The sharp difference in the heights is very evident to the eye in these illustrations.

FIG. 12.

The flattening is by no means always developed uniformly, but, according to the extent and situation of the cicatrix, is only demonstrable anteriorly or posteriorly or in both places at once, so

that we may distinguish an anterior, posterior, and total flattening of the apex.

In the patient shown in Figs. 9 and 10, the flattening, as appears on the photograph, was total, equally pronounced anteriorly and posteriorly. On the other hand the photographs of the anterior and posterior regions of the thorax and neck in Figs. 11 and 12, show flattening on the right side anteriorly and on the left side posteriorly.

I also exhibit the plaster cast of an individual in whom there was considerable flattening of the apex during life, and considerable cicatricial retraction of the corresponding apex of the lung was found after death. This cast (Fig. 13) shows very distinctly the diminished size of the right half of the thorax in its upper portion, corresponding to the condition of retraction in the apex of the lung.

FIG. 13.

You thus see the way in which the process of spontaneous recovery may be followed. It goes without saying that there are manifold variations from the schema which I have described. It is particularly common to find within the cicatrix one or more small cavities which are filled with firm, cheesy, thick secretion, or communicate with the bronchi and continue to secrete for a long time. Perhaps these are finally obliterated by the progressing cicatricial contraction. Such closed or still secreting cavities within the cicatricial tissue present less favorable chances, inasmuch as they offer a favorable soil for the further development of the bacilli, while the latter, when inclosed in the firm cicatricial tissue, enjoy only an apparent existence. The cheesy nodules within the cicatrix are usually very rich in bacilli, may undergo softening at a late period and lead to local relapses or to general infection of the organism. These cheesy foci and small cavities are vol-

canoes which may remain quiet for many years, perhaps for the remainder of life. But an eruption often occurs unexpectedly, and is so much the more astonishing to the physician if he has been unaware of the previous process and the patient had attained mature years. The acute tuberculosis of old people is much more frequent than is commonly supposed, and the appearances after death almost always show the residua of old tubercular processes in addition to the fresh eruptions. The continuance of such a volcano may be inferred clinically from the fact that the secretion of bacilli-containing sputa never ceases entirely, even if the individual appears to be thoroughly restored in other respects, and that the dulness on percussion at the apex does not disappear in the complete manner which is usually the case in simple cicatricial contraction with overlapping of the adjacent emphysematous tissue.

There are families in which, so to speak, the benign form of tuberculosis is hereditary, in which the recovery of tuberculous foci at the apices and roots of the lungs constitutes the rule. In the members of such a family we usually observe the infection of the apex, attended with frequent hæmoptysis, first beginning on one side, and can then follow the clearing up of the dulness and the retraction of the apex. Then the other apex is attacked at the end of years, and permits us to observe the process of resolution in the same way.

If the original tuberculosis, which led to retraction of the apex, was not recognized as such at the beginning, our judgment of subsequent events, for example, the occurrence of relapses in later years, and our comprehension of peculiar tubercular localizations (spine, urogenital apparatus) or of tubercular diseases in the offspring, etc., may be greatly improved by an examination of the height and air contents of the pulmonary apices of the individual in question. Some cases of frequent tuberculosis in childhood in families in which the parents are said to be entirely healthy and never to have been seriously ill, find their explanation in such a cicatrix of the apex, as demonstrated in one of the parents. More careful inquiry into such cases usually reveals useful anamnestic data, for example, that they suffered for a long time, in their youth, from "catarrh," spitting of blood, pleurisy, and chills and fever which did not yield to quinine.

Careful examination of the apex is also very important

with regard to the question of primary tuberculosis of the larynx. It has been repeatedly maintained that the laryngeal mucous membrane may be the primary site of entrance for the tubercle bacillus as well as the lungs. As a proof of such a possibility those cases are adduced in which there was tuberculosis of the larynx, although nothing could be discovered in the chest. I have seen many cases which, at first, created the impression of primary laryngeal tuberculosis, but careful examination of the apices showed the cicatricial remains of older processes. I have hitherto seen not a single convincing case of pure primary laryngeal tuberculosis, but have often observed cases of subacute or chronic tuberculosis of the larynx associated with healed or latent tuberculosis of the retracted apex of the lung.

As a result of Koch's discovery, the microscopical examination of the sputum has assumed the first place in the series of diagnostically important symptoms, because it alone suffices for the diagnosis of "pulmonary tuberculosis." Formerly we sought to discover histological constitutents of lung tissue in order to diagnose the process of destruction. But even the demonstration of elastic fibres arranged like the structure of the lung indicates merely a destructive process and is not pathognomonic of tuberculosis.

Koch's discovery gave a much more exact construction to the diagnostic value of microscopical examination of the sputum: *when pulmonary tuberculosis is present, tubercle bacilli are found in the sputum.* Even if the bacilli are scanty, a few are usually found on repeated examination. It may be regarded to-day as one of the best founded diagnostic principles that when tubercle bacilli are found in the sputum, tuberculosis is present; that when there is pulmonary tuberculosis, bacilli will also appear in the sputum; and finally that in pulmonary affections in which no tubercle bacilli are found despite repeated competent examinations, tuberculosis may be excluded.

The exceptions to these rules, for the present, are acute miliary tuberculosis of the lungs, in which bacilli have not been found hitherto in the sputum, also the completely healed tuberculosis of the apices, in which the callous connective tissue entirely encapsulates the tubercle bacilli.

The great importance of the bacilli in diagnosis is there-

fore evident. A single morphological element decides the question.

Nevertheless, even here you must bear in mind the cardinal principle of diagnosis: never to make a diagnosis on the basis of a single factor, but always from the ensemble of symptoms. I do not mean to question in the slightest degree the pathognomonic significance of tubercle bacilli in the sputum. In the hands of one thoroughly versed in bacteriological methods of examination, the bacillus-containing preparation offers a complete guarantee. I merely warn against drawing conclusions from the demonstration of bacilli by one not entirely familiar with these methods. The discovery and identification of bacilli, however simple they may be, according to the ordinary methods of Ehrlich-Weigert or Ziehl-Neelsen, always require the same practice and care as the other methods of examination, if their results are to be reliable. In case of insufficient practice the importance of an error is so much greater if this single factor is decisive for the serious diagnosis.

I have seen very remarkable things in the practice of colleagues, who despite their other qualifications, had never mastered microscopical technique and therefore made the most remarkable discoveries with the microscope. Be very cautious, therefore, in your judgment and, in doubtful cases, secure the control of your discoveries by some scientific authority.

The question now arises whether the number of bacilli found in the sputum can be utilized in determining the pathological processes in the lung, in other words, whether from a diminution of the bacilli we may infer favorable changes, from their increase unfavorable changes in the tubercular foci. In general this question may be answered in the affirmative. Abundant bacilli in the sputum speak for rapid softening, and are usually associated with fever, night sweats, etc.; scanty bacilli are found in chronic tuberculosis and belong to the secretions of cavities. Gradual diminution of the bacilli in numbers, for example, during a climatic cure, enable us to infer healing processes, and accordingly is usually attended by improvement of appetite, increased weight, apyrexia, cessation of night sweats, etc.

Exceptions to this rule are constituted by progressive softenings with scanty bacilli, if the spot of softening is still shut

off from the bronchi. On the other hand, abundant bacilli are found in old, stable cavities, if their walls are in a condition of irritation with increased secretion, for example, from external irritation.

The diagnosis of pulmonary tuberculosis has therefore received, through Koch's discovery, a degree of certainty such as has been secured for few diseases. This very certainty has greatly increased our knowledge concerning the curability of tuberculosis. The pessimistic standpoint of the old school has been shaken by nothing so much as by Koch's doctrine, for the reason that this has taught us to recognize many apparently harmless cirrhoses of the lung as really tuberculous, and to follow out their recovery. It is, therefore, by no means justifiable to declare a patient, in whose sputum bacilli are found, as lost. At the present time, when the certainty of our judgment of therapeutic measures has increased so remarkably, and when the former timidly expressed hope of the recovery of true tuberculosis has become an incontrovertible certainty, we can proceed to the treatment of tuberculous patients with much greater confidence.

The certainty of diagnosis at the beginning of the disease has also given greater precision to the therapeutic indications and greater certainty to our estimation of the curative effects.

Finally, it is evidently extremely important to be able to exclude tuberculosis in chronic diseases of the lung by the permanent absence of bacilli from the sputum. The diagnosis of simple chronic inflammation of the bronchi and lung tissue, of peribronchitis nodosa, pneumokoniosis, cirrhoses and bronchiectases, pulmonary syphilis and neoplasms, is facilitated by the exclusion of tuberculosis; indeed, in some cases it is rendered possible by this alone. Thus, the clinical study of these diseases, which are so obscure in many ways, has been directed into new channels by the solution of the tuberculosis question.

I now desire to speak concerning a few other appearances found on microscopical examination, and first of the demonstration of elastic fibres. I advise you not to attach any importance to a few elastic fibres in the sputum, but to regard them as a pathognostic sign of lung destruction only when they appear under the microscope connected with one another and in the arrangement which they possess in the pulmonary tissue.

By following this principle, we avoid the mistakes which may arise from the accidental admixtures of bits of meat, fibrous and tendinous shreds, which have remained between the teeth. Elastic fibres, when found in the histological arrangement characteristic of the lung always possess a very notable significance. As we have mentioned, it indicates simply destruction of lung tissue, but if tubercle bacilli are also present, it speaks for progressive tubercular softening and against a stationary condition. Such a conclusion is very important under certain circumstances.

When the elastic fibres are scanty, great patience is required to discover them. Fenwick's method can be highly recommended for this purpose. The sputum is boiled with soda lye (eighteen per cent), then mixed in a graduate with three to four times its volume of water, and allowed to stand for twenty-four hours. The elastic fibres are then found easily in the deepest layer of the sediment.

The pigment cells and myelin cells, which occur in the sputum of tuberculous patients, also merit special mention. In 1872 Buhl, in his letters on "Pneumonia, Tuberculosis, and Consumption," expressed the opinion that the large pigmented granular and myelin cells in the sputum, when they occur in large numbers, are an unfailing sign (which appears as early as the first week of the disease) of beginning desquamative pneumonia which, according to this writer, is the inflammatory initial condition of tubercular phthisis. The amount of myelin, whether free or inclosed in cells, was said to stand in direct proportion to the duration of the phthisical process. At first Buhl's doctrine created great confusion, but it is now generally regarded as disproven.

I have long known that, in the sputum of persons who are confined constantly in a dusty atmosphere at a high temperature, there are numerous large pigmented cells, fat granules and myelin forms, although the lung tissue may not be diseased, and I have repeatedly had the opportunity of proving *post-mortem* the intactness of the lungs in individuals who had expectorated such sputum freely during life. These individuals include particularly bakers, blacksmiths, locksmiths, habitual frequenters of taverns, etc. At my recommendation Dr. Panizza subjected the whole question to an exhaustive clinical experimental investigation. The results confirmed my

opinion of the insignificance of these morphological elements in the diagnosis of tuberculosis. Myelin cells and granulo-fatty cells with and without pigment are found in all pulmonary and bronchial affections, but most constantly and in largest numbers in the superficial irritations of the respiratory surface, which result from a stay in a smoky atmosphere of high temperature. Among 500 healthy and sick individuals, whose sputa were examined by Panizza, pigmented cells and myelin forms were found in eighty-six per cent of the healthy individuals, the sero-mucous morning sputa alone being examined. If the sputa of blacksmiths, locksmiths, carpenters and cooks alone were taken into consideration, ninety-five per cent contained the elements mentioned in very large numbers. These elements did not disappear entirely, although they diminished somewhat, after the individuals had remained in the hospital for quite a long time. Panizza repeatedly found the pulmonary parenchyma intact in the bodies of these individuals, who had died of other diseases. Hence the occurrence of myelin and pigment sputum may be regarded as within the bounds of health, while the specially abundant occurrence of such elements indicates irritative conditions of the respiratory surface.

With regard to the origin of the myelin and myelin cells, Panizza's investigations on the respiratory mucous membrane of the living frog led him to the conclusion that the myelin was identical with mucin which merely swells in water but is insoluble in it, and is only another physical appearance of this substance. According to Panizza this mucin is a secretion of the cup cells found between the ciliated epithelium, is secreted by them under slight irritation, for example, the addition of water in large amounts, and passing to the surface, at first in a wedge shape, by amœboid movements, gains possession of the pigment granules situated on the ciliated surface. Then, after it has received a delicate enveloping membrane, it is pushed upward, as a myelin or pigment cell, by the movement of the cilia.

It is not to be denied that, in permanent irritative conditions of the respiratory surface, for example, in trades associated with a dusty atmosphere, the alveolar epithelium may also take up pigment and appear in the sputum as large pigmented, myelinic cells. But there is no convincing reason

for ascribing the entire amount of these elements in the sputum to such elements. It is much more plausible to assume that the largest proportion of the particles of dust remain fixed to the extensive mucous surface and here becomes imbedded in cells or in elements which assume the cell form at a later period.

But this interesting question of the origin of the pigmented and myelinic cells is surely not yet settled. Like the entire theory of bronchial secretion and expectoration it requires further investigation and explanation. I have merely desired to show that the presence of numerous cells of this character and of free myelin in the sputum has no pathognomonic significance as regards pulmonary tuberculosis, but that it is only to be interpreted, in a very general sense, as the expression of irritative conditions in the tissues of the respiratory surface.

A few remarks concerning the spitting of blood may here be added. That the first pulmonary hemorrhage of tuberculous individuals does not come from healthy tissue but from diseased lobules, may be regarded as proven, and the assumption that a primary pulmonary hemorrhage may lead to phthisis may also be regarded as definitively set aside. There are various pathological conditions which may lead to hemorrhages in a tuberculous lung. From a clinical standpoint I would distinguish two great categories, first, hemorrhages which owe their origin to progressive processes, especially to the softening of coagulation necroses, and secondly, those which occur during a marked retrogressive tendency of the local affection. Grave as may be the significance of hæmoptysis in the beginning of tuberculosis and on the occurrence of relapses, it is relatively slight when there is a marked tendency to recovery, even if it is frequently repeated. In the former, softening and tissue degeneration are the essential causes of the hemorrhage; in the latter, it is the circulatory disturbances induced by the cirrhotic retraction of the pulmonary tissue and the usually insignificant changes in the walls of the cavities. From this standpoint we may say with a certain amount of justification that those who spit blood habitually are not the worst cases for treatment, but rather that they form a relatively favorable category, provided that the retrogressive tendency is well marked.

We are usually quite well informed concerning the course

of the fever during tuberculosis, since the thermometer has become an indispensable household article, at least among families that possess a moderate degree of culture. The patients usually take their temperature oftener than is necessary; every slight disturbance or discomfort induces them to insert the thermometer. This has its good side as regards medical observation, so long as the process is not far advanced. But in later stages, when the fever is high and almost continued, it has its bad side, inasmuch as the permanence of the high temperature often exerts a very depressing effect on the patient. It is then advisable to diminish the number of temperature measurements or to abolish them altogether.

The significance of the fever in tuberculosis is always very great. Constant high temperatures allow us to infer the advance of the bacillary and inflammatory process, while continued apyrexia corresponds to a regressive tendency of the local process. The causes of the fever must always be sought in the local processes, on the one hand in the development of the bacilli, the reactive inflammation of the pulmonary tissue and the fever-producing products of both; on the other hand, very probably in the absorption of products of degeneration from the spots of softening, and of the chemical products of secondary colonies of cocci. But we know very little concerning the significance of the latter in the local and general disturbances of pulmonary tuberculosis. Considered in their extremes, the continued fever of the acute infiltration may be placed side by side with pneumonic fever, while the febrile outbursts of the later stages, which are either erratic or return with a certain regularity, may be compared to the fever of septic infection. Between these extremes are the most manifold mixed forms, the most obscure in their causal relations to the local processes being the slight febrile movements which often last for months. As a general thing we find in such cases, as in the severe febrile forms, a morning remission entirely or almost entirely to the normal, and an exacerbation toward noon or afternoon.

With the exception of the higher grades of absorption-fever, the temperature curve of tuberculosis corresponds to the curve of protracted acute and subacute infection-fever, except that its regularity is not so prominent as, for example, in typhoid fever. This is best shown by hourly measurements

during the entire twenty-four hours. As in typhoid fever, there are usually two elevations, one late in the morning, the other in the afternoon, while after six o'clock P.M. the temperature falls through the night to the morning minimum. In many cases the twenty-four-hour curve presents only one elevation, viz., in the afternoon, more rarely in the morning. Curves with three elevations are much rarer, the third usually corresponds to midnight.

The more the character of the absorption-fever becomes evident, the greater becomes the difference between the temperatures of the remission and exacerbation. The higher the former, the lower does the temperature fall in the morning, not alone to the normal, but often one or two degrees below the normal. To explain these febrile exacerbations we must assume, as in septic fever, either that the reception of pyogenic substances in the circulation goes on with a certain degree of regularity and causes an explosive reaction on the part of the organism, or that the constantly occurring absorption does not lead to irritation of the temperature centre, until the pyogenic substances have accumulated in the blood in a certain amount and that a sort of cumulative action of these substances then occurs. Although we cannot claim, in view of these statements, that the fever in phthisis exhibits a distinct type, it is nevertheless of value to learn its usual course.

I will now discuss an interesting phenomenon in the course of phthisis, one to which a diagnostic significance was attributed for some time, and which in reality occurs most frequently, though not exclusively, in tubercular phthisis. I refer to the so-called idiomuscular contractions, a phenomenon which is due to the abnormal mechanical irritability of the emaciated muscular substance. If a vigorous blow with the percussion hammer or the finger is made upon the pectoral muscle near the sternum in an emaciated consumptive, we do not obtain the lightning-like contraction of the corresponding bundle of muscle in its entire extent, as is observed in healthy individuals, but a hard muscular swelling, corresponding in shape and size to the percussing object, develops and disappears at the end of a few seconds. This brief circumscribed tetanus of the muscle may be combined with the muscular contraction occurring in healthy individuals, but this combination is not constant. It may also be produced at the same time in differ-

ent parts of the muscle or even the same bundle, if the blow is administered with all the fingers at the same time.

In addition to this idiomuscular tetanus another remarkable phenomenon is observed in some consumptives. With the formation of the tumor very superficial delicate waves of contraction are seen to run from it on both sides across the muscle. These run at right angles to the long axis of the bundle which has been struck, and show the extent of the primary mechanical irritation. These waves are seen most distinctly if the handle of the percussion hammer is rapidly drawn, with firm pressure, across the pectoralis and parallel to the sternum. The two delicate waves, which are as long as the stroke, run toward the sternum and humerus, diminishing gradually in extent. If, in such an individual, two or more vertical, parallel strokes are made with the handle of the hammer, we will see the waves running to both sides of each spot of irritation. If the course of these waves is followed accurately, it will be found that when two waves meet, they do not disappear, but run over one another. The more advanced the phthisis and the more wasted the adipose tissue and muscles, the more distinctly and constantly can the phenomenon be produced.

The frequent observation of this peculiar phenomenon, which has been long known to physiologists, led Lawson Tait to the assumption that this sign is pathnogostic of the softening stage of phthisis, and may be used in the diagnosis of the disease and the stage of the disease. Later observers confirmed the occurrence of the phenomenon in advanced phthisis, without agreeing entirely with Tait's statements concerning its pathognostic significance.

Together with two of my pupils, Dr. v. Millbacher and Dr. Stadelmann, I have subjected this interesting subject to careful investigation in various directions and have arrived, in brief, at the following results:

The idiomuscular contraction occurs only when the adipose layer has entirely disappeared and the muscle is profoundly wasted. It may therefore be produced in all patients in whom these conditions are fulfilled, and particularly in phthisis, because here the emaciation has usually reached an extreme grade. But we also found the phenomenon in many other diseases, which cause marked emaciation, as in typhoid fever during the fourth and fifth weeks, neoplasms, etc.

Those muscles which lie upon a firm bony base, upon which they can be firmly compressed by the blow, are alone adapted to the demonstration of the phenomenon. By far the most suitable was the broad pectoralis major, but we could also produce the phenomenon on a series of other muscles with a hard base, for example, the supra-spinatus, infra-spinatus, deltoid, triceps, extensor digitorum communis, tibialis anticus, etc.

We also succeeded in producing a feeble tremor in a few apparently healthy, but very lean individuals.

The histological changes which induce this phenomenon are, on the one hand, the marked atrophy of the adipose tissue and integument, and the simple atrophy and fatty degeneration of the primitive bundles of the muscle, while on the other hand a certain part is also played by the proliferating processes in the perimysium internum and interstitial connective tissue, proliferation of nuclei in the sheaths of the small vessels and thickening of the adventitia of the larger vessels. In the muscles in which the phenomenon had been very pronounced during life, v. Millbacher found E. Fraenkel's "constricted bundles" in unusually large numbers. In addition to nuclear proliferation in the connective tissue and the sheaths of the vessels, he found the bundles, which were constricted entirely or partly in a ring form by the connective tissue, always in the neighborhood of a vessel with thickened sheath; the proliferating connective-tissue coverings of both were often directly connected with one another.

These anatomical changes make it plausible that the anomalous mechanical irritability of the muscular substance, which evidently occurs without nervous influence, is analogous to the increased mechanical irritability of a muscle which has been deprived of nerve influence by division or degeneration of its nerve and has undergone atrophy and interstitial proliferative changes. But the conditions are essentially different. In motor peripheral paralysis the nerves are degenerated as far as the terminal plates, in this condition they are intact; in the former the muscle is entirely withdrawn from volition, in the latter it is entirely capable of function although feeble. In paralysis the electrical reactions of the nerve and muscle change to those of degeneration, the entire muscle or individual bundles react slowly to the mechanical irritation without

the formation of a contraction-tumor. In the condition under discussion the directly affected part of the muscle undergoes brief tetanus and sends out those lateral superficial waves of contraction which are never observed in degeneration reaction in the very excitable muscle. The less valid the analogy between the reaction of the wasted and the paralyzed muscle, the more important are the relations between this phenomenon and the physiological condition of exhausted or dying muscle. The same appearances that we observed in the wasted muscles of phthisis were described by Schiff in the exhausted or dying muscles of mammals, and there can hardly be any doubt that we have to deal, in the wasted muscles of consumptives, with a phenomenon of exhaustion and death, which occurs so much more readily, the more marked the atrophy of the tegumentary coverings.

Although this does not explain the internal processes, it is evident from this physiological parallel, as well as from clinical observations, that idiomuscular contraction has no relation to tuberculosis *per se*, but is merely a phenomenon of emaciation, which goes hand in hand with the general wasting of the body. Hence it possesses no diagnostic significance.

Finally, I will briefly discuss two physical aids to diagnosis as well as to prognosis and the determination of therapeutic indications. We refer to the spirometer and scales, which, in our opinion, do not enjoy sufficient consideration at the hands of the profession.

So far as regards the spirometer I cannot here enter upon the physiological aspect of the question of the pulmonary capacity, but must confine myself to the discussion of a few practical points.

As a general thing the spirometer is very little used, on the one hand because it is commonly assumed that the results depend too much on the skill and practice of the patient to furnish exact and constant values, and on the other hand, because the physician feels constrained by the absence of absolute values for the vital capacity of the lungs in healthy individuals. Both objections are unsound in practice. There are certainly awkward individuals, especially in the lower classes, who are not adapted to investigations in which they themselves must take an active part. But their number is not large, if we take sufficient pains in exercising them. With a

certain amount of patience and practice we even succeeded in making spirometric measurements in my hospital wards. It was distinctly noticeable that the women were generally more awkward than the men.

It is true that the impossibilty of securing absolute values of the vital capacity of healthy individuals constitutes an imperfection, inasmuch as the dimensions of such capacity depend on very different factors. Among the latter the most important part is played by the height of the body, inasmuch as the vital capacity and the height have a sort of constant relation to one another, which varies in the two sexes. The other factors, such as circumference of the chest, length of the trunk, bodily weight, age, occupation, etc., do not, by far, affect the vital capacity to such an extent as the height of the body. The inconstant factors which may influence the result, viz., a full stomach, gaseous distention of the intestines, position of the body, etc., may be avoided. I therefore recommend, based on an experience of many years, that only that relation be determined which exists between the volume of expired air and the length of the body. Both values are found without difficulty and the calculation of their relation to one another is made in a moment. Hutchinson, the inventor of the spirometer, and Wintrich calculated the vital capacity of healthy individuals according to definite measures of height.

I have endeavored to find a sort of limit for the relation between normal and subnormal respiratory magnitudes, and found the minimum proportion in healthy individuals 1 : 20, *i.e.*, 1 cm. of length of body to 20 c.cm. vital capacity in males, and 1 . 17 in females. As a matter of course, these figures have only an approximate value. But as we generally have to deal, under pathological conditions, with very large differences, the lack of exactness in the outside limits is thus compensated for practical purposes.

Moreover the chief value of spirometry does not reside in the determination of the absolute respiratory magnitudes, but in the condition of the vital capacity of the same individual during the course of a long period. Hence, spirometry is less important in the primary diagnosis of the disease than in the recognition of changes in the function of the respiratory organs during observation and treatment.

The pathological conditions of the respiratory apparatus,

which diminish the vital capacity, are remarkably varied. All acute and chronic diseases of the lungs, pleura, heart, bones of the thorax, and finally, affections of the abdominal organs which narrow the thoracic cavity, may have this effect. Hence, the results of spirometry can only be supplementary of those of other modes of examination. Apart from tuberculosis, I would mention obliteration of the pleural cavity as the result of pleurisy, adhesive elevation of the diaphragm, pulmonary emphysema and cirrhosis, and bronchitis as the source of the most important changes in vital capacity. It can, therefore, only be said in a general way that when the proportion of the height of the body to the vital capacity falls below 1:20 or 1 : 17, we must assume a considerable disturbance of the respiratory organs, whose character is then to be determined in other ways. If a proportion of 1 : 25 (1 : 22 in females) is found, such disturbance is *a priori* improbable.

The absolute value of these measures may be shown by an illustration. An unusually tall, lean young man of twenty-five years, the son of a father who has died of phthisis, is brought to you by the anxious mother, in order that you may decide whether the leanness, pallor and lack of robustness are due to pulmonary disease. Physical examination gives negative results, but a few coarse râles in the upper lobes with anæmia, paralytic thorax, poorly developed muscles, palpitation of the heart and a tendency to perspire on vigorous muscular action, make you suspicious of a developing tuberculosis. Spirometric examination shows a vital capacity of 5,000 c.cm. the height of the body being 186 cm., *i.e.*, a proportion of 1 : 27. The exclusion of tuberculosis thus gains in certainty and the indications for treatment become more distinct. Three months later the same vital capacity is found and the measures adopted in the mean time (shower baths, sea bathing, mountain climbing and gymnastics) have had an excellent influence on the general nutrition, on strengthening the muscles, the color of the skin and mucous membranes, and also on the palpitation of the heart.

The following case forms a companion piece. A young man, whose family is said to be healthy, suffered from hæmoptysis a short time before, and since then has had a slight dry cough without expectoration, but is otherwise not notably affected. Examination of the lungs shows a scarcely percept-

ible difference between the apices, also a few coarse râles and prolonged expiration. The pleuræ are free, the elevation of the diaphragm and mobility of the borders of the lungs normal. The spirometer shows a constant vital capacity of 3,200 c.cm., the height of the body being 175 cm., *i.e.*, a proportion of 1 : 18. The diagnosis of beginning tuberculosis of the apex is thus made quite certain. A few weeks later sputum is obtained and tubercle bacilli are demonstrated in it.

The relative value of spirometry is shown most instructively in cases in which distinct changes in the respiratory apparatus are found and in which the spirometric examination is repeated from time to time during the further course of observation. If a slight increase in vital capacity appears during climatic and other cures, this result, which is usually associated with improvement in other repects, is extremely valuable as regards prognosis, while rapid or slow diminution of vital capacity supplements the other unfavorable symptoms in the most serious manner. The following is an illustration:

A woman of twenty-eight years with a feeble hereditary taint (tuberculosis in the maternal aunts) with undoubted tuberculosis of the apex, bacilli in the sputum, etc., presents a constant vital capacity of 2,600 c.cm., with a bodily height of 160 cm., *i.e.*, a proportion of 1 : 15.6. The patient spends the winter in Meran, is without fever almost all the time, practises methodical climbing, increases in weight 6 kgm., and in the following May shows a vital capacity of 2,700, *i.e.*, a proportion of 1 : 17. Four years later the patient is still well, the dulness at the apex has disappeared almost entirely, bacilli are no longer found in the sputum.

But I could adduce a much larger number of cases in which the continued measurement of the vital capacity showed a steady diminution. The differences may become enormous, partly on account of the progressive infiltration, partly on account of the fever, muscular weakness, etc. Thus, in advanced cases we are often unable to obtain a proportion higher than 1 : 8

When a rapid considerable diminution of vital capacity is observed, we can only infer an extension of the tubercular process when the physical examination also furnishes data, and extensive bronchitis, pleurisy, high fever, etc., may be excluded.

Finally, I desire to recommend to you the scales, an apparatus equally important in diagnosis and prognosis. It has long been in general use in hospitals and retreats for consumptives, but seems to be employed very little in private practice. The determination of the weight of the body has only a relative, not an absolute value. For, if we disregard the extreme loss in weight of a patient in the last stages of phthisis, then from the fact that a patient weighs 50 or 70 kgm. we can draw a diagnostic conclusion much less than from the absolute value of the vital capacity. In the latter we possess at least the height of the body in measuring the volume of the expired air. But the height of the body can hardly be utilized in deciding whether the weight of the body is normal or subnormal, because there are phthisical individuals who, on account of their large frame, are very heavy, while very lean and delicate individuals may be entirely healthy, despite their low weight. Hence an absolute value of the weight of the body in the diagnosis or exclusion of tuberculosis can only be conceded in so far as the extremes in the upward or downward direction testify in general for or against the diagnosis.

But the value of weighing the body is much greater if repeated at regular intervals, as is done in many health resorts and hospitals. If the diagnosis of tuberculosis has been made, the scales offer the possibility of determining whether the process is advancing or retrograding, whether fever is present or not, whether the ingestion of food and assimilation are sufficient or insufficient. Mere stability of the weight of the body is a factor of favorable significance, inasmuch as it speaks with probability against the progressive character of the affection.

Steady diminution in the weight of the body has a decidedly unfavorable significance, and so much the more the more rapidly it progresses, as it teaches that the entire economy is suffering rapid destruction under the influence of the fever.

On the other hand, a steady though slow increase in weight, especially in connection with the other local and general symptoms, indicates the checking of the fever and an improvement in the appetite and assimilation (it is assumed, as a matter of course, that a careful physician will not be deceived by an œdema of the lower limbs, which also leads to an in-

crease in weight). Thus the scales, even without the assistance of the physician, for example, during the patient's stay in a health resort or in the country, will furnish him with an opinion on the course of events in the same way as is done by regular measurement of the vital capacity by means of the spirometer. Every loss in weight from the average calls the attention of the patient to the fact that something is wrong, and induces him to obtain the advice of the physician. On the other hand, increase in weight tells him that his condition is satisfactory, increases his confidence in the efficacy of the measures recommended and his persistency in carrying them out. To the physician the tabulated or graphic representations of the regular measurements possess great interest and afford him, even if the patient is at a distance, a tolerably reliable judgment on the results of treatment. The table of weights which the patient sends to his family thus form a sort of book-keeping of the results of our therapeutic endeavors.

These are the points to which, because of their importance for our medical opinion, I wished to call your attention. The importance of an exact diagnosis in the earliest stage of tuberculosis will be often seen in your future practice. Here, as in other diseases, Van Swieten's weighty expression holds good: "Qui bene diagnoscit, bene medebitur."

CHAPTER III.

THE TREATMENT OF TUBERCULOSIS.

THROUGH the discovery of the bacillus as the cause of the disease, the treatment of tuberculosis has gained new standpoints, although no essentially different results have yet been obtained. The first thought was to direct all therapeutic efforts against the bacterium, and expression was given in various quarters to the hope that means would be found which, conveyed to the living organism in sufficient amounts without causing injury to it, would impair or abolish the vitality or propagation of the bacilli. This hope of sanguine investigators has not been fulfilled, and there is very little prospect that it will ever be realized. However, modern medicine makes it more advisable than ever not to play the prophet, and we will therefore not cloud with doubts the hope of those who anticipate the future destruction of tuberculosis in the human race. But even in the absence of specific remedies, much can be done in the treatment of tuberculosis, especially in the domain of regimen, by a suitable mode of life adapted to the needs of the individual organism.

Graves' proposition, adduced by Hermann Weber, will be the starting point of our discussion: "It would be of the greatest importance to know how an individual could be made phthisical, since by following out the opposite method, we could prevent phthisis." Now, gentlemen, this wish of the highly deserving Graves has been fulfilled by recent investigations, inasmuch as they have disclosed the materia peccans and have taught the most favorable conditions for its acquisition. We now possess sufficient facts and observations to teach what injurious influences favor the development of tuberculosis, whether an hereditary predisposition is present or not.

I have mentioned these injurious factors in a special lec-

ture on the etiology of tuberculosis. I will, therefore, content myself now with defining those standpoints which necessarily follow from the consideration of the harmful factors and their effects.

Let us start from the observation, which I communicated to you in the lecture referred to, of the development of tuberculosis in previously healthy individuals within the walls of a prison, convent, or hospital. Our Sisters of Charity, whom we see exercising their blessed activity all day long with the greatest zeal and self-sacrificing devotion in our hospital wards, teach us most clearly how tuberculosis is acquired, what factors favor the colonization of the bacillus in the lungs; the constant atmosphere of a room, very little or no exercise in the open air, severe labor, monotonous diet, very little recreation, and much watching at night. These factors are the most important. Experience also teaches that mental disturbances, spiritual struggles, worry, etc., may also aid in impairing the resisting power of the organism.

Now, how does the disease develop? With what premonitions does it begin? The beginnings, as Baer also describes them in the case of convicts, are imperceptible, and form rather the picture of anæmia with muscular weakness and loss of appetite. Cough and respiratory disturbances are not necessarily present, although infiltrations may be revealed by physical examination. These latent infiltrations with rapidly following destruction were found by Baer particularly in those prisoners who had been subjected for a long time to unusually exhausting muscular exertion, frequent penal fasting, and the action of great worry and deep remorse.

These paradigms of the most favorable conditions for the development of tuberculosis must be especially considered in fixing the general rules of prophylaxis. Here we see best what we should not do. Instead of remaining in-doors, out-door exercise; instead of exhausting constant work in-doors, regular, not too exhaustive out-door exercise with intervals of rest; instead of meagre fare, a generous diet (corresponding to the muscular labor) of albuminoids, fats and carbohydrates with avoidance of monotony; slightly stimulating drinks, at least seven hours' sleep, a frequent stay in the country; with complete cessation of all work. This schema of an anti-tubercular mode of life may be extended in the case of wealthy

patients. Recreation should be sought in mountain or sea air, which is as free as possible from dust and bacilli, the muscular work with its deep respirations should be made in the pure air of the mountains by climbing, on the sea by battling with the winds, exercising on the ropes, etc. The chief factor is the inspiration of fresh air with the deepening of inspiration due to out-door muscular effort. Simple diet, a great amount of work and little sleep are enjoyed by Pommeranian laborers and hostlers during the entire summer, although they do not become phthisical on that account. On the contrary, they thrive admirably in the open air, because they always have an enviable appetite, unexceptionable muscular power, good sleep and cheerful temperament.

The most important postulates of the prophylaxis of phthisis, accordingly, are the avoidance of impure air in the rooms and of insufficient out-door exercise. The question then arises, why are the prisoners not made to work in the open air? Why are they squeezed together in the work-rooms with their deleterious atmosphere? If it is possible to keep the insane permanently at field work and to supervise them, why is this not possible in the case of prisoners? It is certainly not the object of the legislator that the criminal, who is removed from the pale of human society as a safeguard to the latter, should be made sick and die. The legislator strives to punish and improve, not to kill. But as matters now stand, and always have stood, a sentence of five to twenty years or a life sentence is at the same time a condemnation to imminent risk of tuberculosis. The hygiene of prisons has been improved immeasurably, and the severe epidemics of typhoid fever, dysentery, scurvy, etc., which once decimated the prisoners, have disappeared on account of the improvement in sanitary arrangements. Tuberculosis alone remains, and its mortality is remarkable, three to four times higher than among the free population. In Millbank, the largest prison in England, 12 per 1,000 died of phthisis between the years 1825–1842, while in the town the mortality from phthisis at the same age was only 4.37 per 1,000. Among the 205 prisoners who died during the years mentioned, 83 succumbed to phthisis, and in addition 90 were discharged from the hospital, suffering from advanced tuberculosis.

The proportion is about the same in Prussian prisons. In

Ploetzensee, 139 prisoners died from 1873–1882, of whom 91 (65.4%) died of phthisis; in addition, 40 consumptives were released. These are facts which are observed in almost the same proportion in all prisons. A high mortality rate from phthisis with relatively good hygienic conditions in the prisons and a relatively very low mortality in general! At the same time the figures which indicate the frequency of the disease are by no means high enough, because the autopsies on the majority of prisoners who have died from other diseases, also show more or less advanced tuberculosis. Baer sums up his experience as prison physician as follows: an intact, *i.e.*, non-tuberculous, condition of the lungs in the body of a prisoner is to be regarded as an exception to the rule.

In weighing the reasons for the danger from phthisis, another factor must be considered. It is not the general prisons and penal institutions, in which the inmates inspire the foul air of the common work-room and dormitory, that show the highest mortality from tuberculosis, but the cell prisons, despite the fact that the healthy are entirely separated from the sick, the allowance of air in the cells is much larger than in the common rooms of the prison, and that the air, floor, and walls are kept much cleaner. In view of the ubiquitous character of the tubercle bacillus, the infection must be mainly the result of the exclusion of the individual from the outer air and from muscular work out-doors. It is not to be denied that the diet is monotonous and often insufficient, nor should the psychical factors of lonesomeness, ennui, remorse, and desire for freedom be undervalued. But I believe that, with an abundance of fresh and moderate healthful out-door work, not alone would the appetite and sleep be better, but the downcast mood and depression would also be improved.

These considerations surely merit the attention of legislators, since it has been so clearly proven that a change of occupation and the enjoyment of fresh air must be regarded as undoubtedly the chief factors in the removal of the evil. The possibility of changing the existing conditions in this respect will not be denied by any one who is acquainted with the enormous improvements of the last fifty years in prison hygiene.

What is true of prisons is also true, mutatis mutandis, of other occupations which predispose to tuberculosis, which are

attended with the aggregation of large numbers of people in overcrowded, unhealthy apartments, and with diminished respiration in the open air.

It has been determined statistically with regard to the soldiers of the French and English armies that the number of phthisical affections rapidly diminishes with the beginning of war operations and manœuvres, and rises at once with the return to peaceful life in the barracks. The German army undoubtedly owes its slight tuberculosis-morbidity not alone to the careful selection of recruits and to the good hygienic condition of the barracks, but chiefly to the marches and other open-air exercises which are carried out regularly during the summer and winter.

This is also true of all seminaries, orphan asylums, and schools of a conventual character. The greater the interference with the free movements of the youthful individual, the more frequent is tuberculosis in such institutions. Fourcault's examples furnish the most striking proof of this. In fact, state supervision of the hygiene of seminaries and similar institutions, especially girls' boarding-schools, is urgently required. The degree of freedom and of active out-door exercise among the youth of Germany is much too small. Even in the public schools, especially the middle schools, the youth suffer from pedantic restriction of the enjoyment of fresh air in the intervals between lessons, owing to the over-anxious care for order and discipline. At home, also, the child must return to his lessons immediately after lunch. There are, no doubt, many bright pupils who easily master their home lessons in an hour, and then have time for walks, play, or instruction in music, but the average pupil, if industrious, works the greater part of the afternoon and evening at his lessons, and goes into the open air very little or not at all. How many constitutions are destroyed yearly by this preposterous mode of life! Look at the pale, lean boys and girls as they leave school tired and worn at the end of the school day, and compare them with English boys and girls, who are permitted to enjoy every free moment, in school as well as out, in playing ball, climbing, wrestling, rowing, etc. What a difference in the complexion, the brightness of the eyes, the activity of the bodily movements! I know large "middle schools" in which, during the only morning interval at ten o'clock, the pupils are allowed to

remain only seven to eight minutes in the open air, and even during these few minutes they are not allowed to run and jump about the play ground, but must walk to and fro in sober conversation.

One of the best judges of English conditions and at the same time one of the most prominent and esteemed German physicians in foreign countries, I refer to Dr. Hermann Weber, of London, called attention, in an address at the Third Congress for Internal Medicine at Berlin, to these differences in the physical education of the pupils of Germany and England. In a recently published series of lectures on the hygienic and climatic treatment of pulmonary phthisis, he has again pointed in an urgent manner to the necessity of more careful attention to the physical development of the young, their stay and games in the open air. In Germany the attention of physicians, so far as regards school hygiene, has been directed chiefly to myopia and its causes. It is time that medical influence should extend also to securing sufficient recreation, the proper selection and supervision of games during this time, regular measurements of the vital capacity of the lungs in each individual, of the weight of the body and its relation to the size, and finally the muscular vigor. From such regular examinations, which it would be sufficient to perform every three months, important conclusions could be drawn with regard to physical education, and the school would thus be in a position to furnish the parents with useful recommendations for the improvement of the constitution of the individual pupils. Half a day spent every three months in these examinations would not interfere with school duties, would surely be very valuable as regards the physical development of each individual, and would furnish directions for those pupils who suffer from a feeble constitution or a direct predisposition to tuberculosis. In both conditions the supervision of the bodily development and education must be the subject of the constant attention of the family physician. Every catarrh, swollen gland or skin disease, in short every affection, even one which is apparently insignificant and would be hardly regarded in one not subject to an hereditary taint, must be carefully looked after and treated. Even apart from such disturbances, ceaseless attention must be paid to the physical development of young people who have an hereditary taint or are at all

suspicious as regards tuberculosis. You must insist that the boy or girl should pass several hours a day in the open air, you must prescribe the bodily exercise and see to it that not only walks are indulged in, but also base ball, turning, skating, rowing, bicycling, mountain climbing. This is to be done not alone during vacations, when it is a matter of course, but especially during the school season, when the constant sitting, in a bent-over position, in the foul air of the school-room and at home over the books, takes up the day.

The opinion of the physician should also be decisive with regard to the choice of the life occupation, for those who have a tubercular predisposition. Unfortunately his opinions are not sought, in many cases, or are not complied wtih. In general it may be said that predisposed individuals should avoid those occupations which entail constant stay in the impure air of closed rooms and insufficient muscular activity. Those occupations are to be recommended which bring the young man in constant contact with the fresh air and maintain the muscular and respiratory systems in vigorous action. Military service, farming, forestry, gardening, marine service, and among the learned professions, theology (with an eye to a country parish) and medicine (because the whole world is open to the physician)—these are the pursuits which are attended with the relatively slightest dangers to one suffering from an hereditary taint. For girls we recommend gymnastics, the avoidance of knitting and sewing, walking, climbing.

Do not believe that these are theoretical deductions. On the contrary, they are derived directly from practical experience. From my own experience, I could adduce many illustrations of the great importance of the proper selection of an occupation for the health and life of the threatened individual, but I find none so striking as the history of a tuberculous family, reported by H. Weber in his lectures, and which my esteemed friend will surely allow me to repeat.

A teacher of languages and his wife, both coming from tuberculous families, died of phthisis in rapid succession under Weber's treatment. Of their seven children one had already died of tubercular basilar meningitis. The six living children who were one to twelve years old, were healthy with the exception of the youngest, who was somewhat rachitic. The history showed further, that among eleven cousins of these

children, nine died of phthisis before the end of the twenty-eighth year of life. It was, therefore, hardly possible to imagine a more serious hereditary taint than that of these poor orphans. They were adopted by well-to-do relatives in a mountainous part of Silesia and physically were bred very rationally according to the above-mentioned principles. What was the result?

The eldest son was healthy, so long as he remained in the open air, until, in his twenty-sixth year, he devoted himself to the study of comparative philology. He now worked day and night, neglected physical exercises entirely, took his meals chiefly in his study, and died of galloping consumption in barely eighteen months. The second son devoted himself to farming and enjoyed the best of health until the age of twenty-nine years. He then found his calling insufficiently remunerative, began to work in a commercial house, in which he passed the greater part of the day in a poorly ventilated office, and in addition studied industriously at home. At the end of two years of this severe "city work" he suffered from repeated hæmoptysis and died after barely two years' duration of the disease. The third son became a cavalry soldier, led a rational life and is a vigorous man of healthy appearance. The fourth child, then a girl of five years, is now the wife of a country minister in a healthy part of Silesia, has no children and is perfectly healthy. The youngest son, rachitic as a child, is a strong man. He is a farmer in Manitoba and his youngest sister, the sixth child, who lives with him, is also healthy and vigorous.

You see how favorably the external conditions of life may act even with a severe hereditary taint, and how deeply the neglect of hygienic principles is revenged.

We do not mean to imply that the history of tuberculosis in this family, which extends over a period of thirty years, is now completed. Unfavorable conditions, worry, grief, but particularly the sudden change from life in the open air to that in-doors, may cause the development of the already present, but latent tuberculosis or cause direct infection. We often find such cases in practice. People die of rapid tuberculosis at the age of fifty or sixty years, although they had previously been either entirely healthy or had merely suffered from "catarrh" in youth or in later life. At the autopsy the

lungs of such individuals often show old residua of a healed tuberculosis in the shape of slaty cicatrices at the apex, which inclose cheesy or calcareous nodules or small cavities, or are entirely solid. That these are really due to a healed tuberculosis is proven by the fact that, after diligent search, we often succeed in finding a few tubercle bacilli in them, and in the old pigmented, cheesy, swollen bronchial glands.

Such autopsies on old people, in whom a cured tuberculosis can be demonstrated, often explain an entire series of tubercular affectious among the children, which no one could understand because the parents had been regarded as entirely healthy. The tuberculosis which had been cured in youth, had either been overlooked or was euphemistically called chronic catarrh, etc., by the patient and his family.

But if we have the opportunity of making a careful examination, we can usually diagnose such healed tuberculosis in old people with tolerable certainty at the end of many years, by the flattening of the apex, the slight differences in the intensity of the percussion sound and the quality of the respiratory murmur. This is important to life insurance physicians.

We now come to a point in prophylactic therapeutics whose importance is perhaps greater, perhaps less, than is supposed at present—I mean the prevention of tubercular infection.

The contagiousness of tuberculosis was a necessary corollary of Koch's doctrine, and the prophylactic measures also necessarily followed its adoption. But clinical experience hardly testifies in favor of infection from man to man, and the hitherto obtained results of the so-called collective investigations on tuberculosis, which have been undertaken in France, England, and Germany, have not been very favorable, so far as we can see, to the assumption of direct contagiousness.

Nevertheless it is certainly advisable, in families in which one of the parents is phthisical, to bring the subject up without circumlocution, and to insist that the patient should not kiss the wife (or husband) or the children; that the removal and disinfection of the sputa should be properly carried out; that he should not expectorate on the carpet; his handkerchiefs should be separately disinfected, his rooms, with the carpets, curtains, and furniture frequently cleaned, and constantly

kept aired. If practicable, the patient should not occupy the same room as the conjugal partner or children, and above all should not share his bed with healthy individuals.

It is evident that these serious precautions must be odious or at least annoying to all parties. The healthy ones exhibit dread of the patient, are afraid of being infected by him, and this is so much in opposition to the family feelings and habits that not much can be expected from it in practice. The prophylactic directions of the physician will be more apt to prove of service to the children, if the father and mother are reasonable. Infection of the child by the mother seems to occur chiefly in the first years of life by the constant kissing, the soiling of the food with the sputum, the air of the mother's bed room. The physician must appeal to the self-sacrifice of the mother in behalf of her child. He must explain clearly the danger of infection of the infant, and must let her know that the life and health of the child are in her hands; the mother's heart will, without hesitation, concentrate all her tenderness for the child upon the care of its well-being.

As a matter of course, a consumptive mother may not nurse her child, nor should a tuberculous wet-nurse be selected. It is true that the bacillus has not yet been found in the milk of consumptive parturient women, but it seems to be merely a question of time when this proof will be brought, inasmuch as the infectiousness of the milk of cows suffering from pearl disease, even if there is no tuberculosis of the udder, has been proven experimentally.

The danger of tubercular infection of the infant by the milk of tuberculous cows, especially if the latter are suffering from ulcers of the udder, is not very great absolutely (the occurrence of the pearl disease in cows is estimated at the most at two per cent). But the danger is relatively great if we remember that the consumer has no control over the source of the milk, rarely knows the condition of the herd from which the milk is derived, and never knows positively whether it is a part of the general mixture or is obtained directly from a diseased animal. Hence it is advisable in every case to sterilize all milk that enters the house, by boiling, five minutes being amply sufficient. That this is really done by the cook is ascertained with difficulty, unless the mistress of the house attends to the matter.

The danger of infection by the flesh of tubercular cattle is abolished by the inspection of the slaughter houses. On the other hand we cannot avoid a certain degree of suspicion against butter and cheese whose source is unknown, and which may be infectious if obtained from diseased cows. But timid individuals may be relieved by the conviction that bacilli or spores, which are swallowed with the butter or cheese, are a much less source of danger to the adult with his vigorous digestion than the ingestion of the milk of diseased cows is to the infant. Finally, the anxious individual is always at liberty to abstain entirely from the use of butter and cheese.

As regards the direct infection of healthy persons upon whom devolves the care of consumptives, such as sisters of charity, nuns, orderlies and nurses, the prophylactic measures are evident from the above remarks. An abundant supply of fresh air and out-door exercise must be secured in the intervals of nursing, sufficient sleep obtained, the stay in the sick-room curtailed as much as possible, a well-aired adjacent room with open windows being selected. The clothing of the patient, especially the handkerchiefs, must be washed separately. The safest plan is to place the articles to be washed in a five-per-cent solution of carbolic acid immediately after using. The floor should be often wiped with a solution of corrosive sublimate, the furniture beaten and brushed every week in the open air, and the walls and ceilings rubbed occasionally with bread. The eating and drinking utensils of the patient should be kept separately. In this way the nurses or relatives can feel tolerably safe in private practice, even if the nursing is long continued, and at the same time nothing need be omitted in the care of the patient. The main factor is the regular and sufficient supply of fresh air and active out-door exercise, and in order to secure this for the attendants in opposition to the patient, who is always selfish and does not wish to lose his nurse for an hour, the physician must speak decidedly and decisively, in order to maintain the attendant's health and ability to work. In the end, this is really to the advantage of the patient. The physician must tell the exact number of hours during which the wife or daughter of the patient is to be in the open air, because the former will hardly venture voluntarily on such a long absence, which the patient might interpret as lack of interest or desire for pleasure. The medical

man must think not only of the patient, but also of those around him, whose untiring activity for the benefit of the patient so often turns out to their injury, without any advantage to the patient from the sacrifice. Consideration for the healthy must often be placed above that for the sick.

Upon the male and female orders for the care of the sick we have no influence, because the rules of the order and the directions of the prior or prioress are decisive. Many a blooming existence in such orders could be saved, many an individual maintained in long and blessed activity, and the cases of disease and death could certainly be reduced one-half, if medical recommendations were listened to, and the health of the individual ranked higher than the rules of the order. Thus hundreds of these admirable, self-sacrificing creatures are yearly destroyed without benefiting humanity, indeed we may say that they are crushed by the wheels of an unbending mechanism. It may be said that these nurses do not suffice for the constantly increasing demands upon them, and that this must lead to over-exertion of each individual. I must reply that the nurse's ability to work has its bounds, that these bounds are usually exceeded by the superiors from the worthy motive of securing proper nursing for as many patients as possible, and that, therefore, the care for the well-being of the self-sacrificing individual, which is also in the interests of suffering humanity, must be placed entirely in the hands of the consulting physician.

I will here mention a few other points in prophylaxis which I regard as especially important for the protection of predisposed individuals or those who are, at least, exposed to infection. I have previously said that the main principle is the free inspiration, deepened by out-door muscular action, of air which is as free as possible from dust and bacilli, and that this is best fulfilled by living in the mountains with climbing exercises, or upon the sea, or at least the sea-coast, with rowing, etc. But comparatively few people have sufficient means for remaining in such places for months or years. For those in moderate circumstances an excellent substitute is a stay in the country more or less remote from large cities, if possible with the opportunity for hunting, rowing, bicycling for the young men, while the young women must be contented with tennis, bowling, and running. Every moment of favorable weather must be spent in the open air.

In order that the children of the poorer classes, especially those suffering from scrofula, anæmia, hereditary taint, may participate in these trips, which exert an equally good hygienic and mental influence, friends of humanity have formed the so-called "vacation colonies," an institution of eminently practical importance, which we would desire to see extended as far as possible. The effect of such a vacation on the health of feeble children, who have grown up amid poor surroundings, in small damp rooms and on meagre fare, is very favorable and many a tottering constitution is thereby strengthened and directed into normal channels.

The asylums for children at the sea-coast seek the same object, and are of the greatest advantage to scrofulous and feeble organisms, but from the nature of things can only benefit a small number of individuals.

Inasmuch as almost the whole day is occupied in their work, it is more difficult to secure the indispensable fresh air and out-door exercise for young adults who have a fixed occupation, for the numerous young merchants, artisans, civil officials, etc. These should be advised to join a gymnasium, bicycle club, etc., because they thus bring fresh air into the lungs while engaged in physical work and strengthen the entire respiratory apparatus. This is, at all events, much better than to visit the tavern at the close of the day and to remain there for several hours in the hot, smoky atmosphere. The sputum of constant visitors in saloons, which I examined with Panizza in numerous cases, showed from the large number of cells with their enormous number of particles of carbon and myelin, that the respiratory surface is subject to constant irritation, even if slight, in such localities, and this may increase the predisposition to the reception of the bacilli, in view of the incomplete expansion of the lungs. But gymnastics in closed rooms, if the formation of dust is diminished by the use of tan bark, is a real benefit not only to the lung and respiratory muscles, but also to the other functions and systems of the body.

I will not close this chapter of prophylactic therapeutics without mentioning hydro-therapeutics, which plays an extremely important part here as well as in developed tuberculosis. Winternitz, to whom we owe most of what is to-day known as scientific hydro-therapeutics, has recently given his

experience on the value of hydropathic treatment of tuberculosis and its predisposing conditions of weakness in an admirable treatise entitled "Studien zur Pathologie und Hydrotherapie der Lungen-Phthise," which I urgently recommend for study. My experience on the value of the "hardening" method in the hereditary and acquired predisposition coincides entirely with that of Winternitz. Water, or the temperature conveyed to it, is the best, simplest, and most accessible means for strengthening and hardening a feeble body, which is predisposed to catarrhs and colds. Even the simple rubbing of the entire surface, immediately after rising from bed, with a wet, cold (at first lukewarm) cloth accustoms the skin to sudden cooling, exercises the neuro-muscular system of the peripheral arteries to prompt reaction, and acts as a thermic irritant centripetally on the central nervous system, and from thence acts eccentrically, stimulating the innervation and functions of respiration, circulation, and digestion. I usually begin this method with lukewarm rubbings (water at 24° R., cloth firmly wrung out) and reduce the temperature of the water ½° R. every day. Winternitz claims that such lukewarm rubbings do not exercise a milder action than the cold rubbings, but my experience is different, perhaps for the reason that Winternitz has made his observations mainly in his water-cure establishment, while I derive mine chiefly from private practice. And here, as I can say with positiveness, it is not immaterial whether the rubbing is performed at a temperature of 12° R. or 24° R., apart from the fact that this somewhat terrifying procedure can be carried out much better in nervous and sensitive individuals if we begin with higher temperatures. It is also very important that the rubbing should be very brief (only lasting one minute) and that the cloth should be well wrung out. Remember that our object is to exercise a thermic and mechanical irritation on the cutaneous nerves and vessels, and not to withdraw considerable heat from the body. This would happen if much cold water were left in the cloth and it should be entirely warmed at the expense of the bodily heat. Nor does the object desired require a very low degree of temperature; it is rarely necessary to go below 15° R.

In feeble individuals, whose appetite and disassimilative processes are below par, I add to the water, after the third

week, one-half to one pound of common salt and one-quarter of a litre mother-lye, making an artificial brine. This exercises a more vigorous and prolonged stimulus on the nervous system than the simple thermal irritant, and, like the action of the brine-bath, increases the nutritive changes and the desire for food.

In private practice these rubbings may be carried out even in the poorest family, entail no expense, and are adapted to every occupation of the patient, inasmuch as they are performed in the morning immediately after rising, after which the patient may dress and attend to his work. A return to bed is permitted only at the beginning when the patient is extremely feeble. He is advised to exercise in the open air, if the weather permits, and does not take breakfast until half an hour later. Very delicate individuals, particularly women, may be permitted to take a cup of warm coffee or tea before the rubbing.

Patients who have no attendant to perform the mechanical work of rubbing, must rub themselves, as well as they can, with large towels or obtain an apparatus for a shower douche. The shower bath does not entirely replace the rubbing, because the intense mechanical irritation and the uniform application to the entire surface are wanting, but it is nevertheless a valuable means of hardening and strengthening the body.

I do not ascribe any notable effect to the partial frictions with brandy, in which salt is dissolved, that are used in certain resorts for consumptives. At the most I would recommend them for hypersensitive patients as a preliminary to the cold-water rubbings. I regard the shock-like action of the wrapping of the body in the wet cloth as the chief element, because this effect provides for the habituation of the surface to the sudden action of wet and cold, the necessary promptness of the cutaneous vessels, and the hardening of the sensory nerves of the skin.

If we wish to proceed still more thoroughly, we may allow the patient to go through a complete water cure in an institution, but this is only necessary in persons who are wanting in will power. The majority have sufficient persistency to carry on the rubbings at home with the aid of relatives or servants for months and years.

The effect of this simple procedure, which may be varied in different ways, is one of the best that can be attained by the physician. It removes the sensitiveness to changes of temperature, wind, and moisture, and the tendency to colds, removes the constant gentle perspiration, the everlasting nasal and bronchial catarrh, the rheumatic disposition, etc. It gives to the body a freshness and elasticity which can only be secured in a similar way by brine baths or sea-baths.

The great advantage of the rubbings, that they may be employed at home and without expense, and that their good results may be utilized for months and years, is of extreme importance in daily practice, especially among the poor.

Among the well-to-do the natural brine baths and sea baths may be used to advantage for hardening and strengthening the constitution, particularly the sensitive respiratory surface; the quite similar action of both depends upon a series of factors. In sea bathing the chemical and thermal action of the cold salt water and the mechanical irritation of the movement of the waves come into play, together with the rapid movement of the air, which is almost free from dust and bacteria, while rich in water and chloride of sodium. All these factors stimulate and invigorate the nervous system and through it all the functions of the organs. They act particularly on the appetite, nutrition, and upon the respiratory apparatus which is forced to take deep respirations and whose epithelium is strengthened by the rapid motion and other qualities of the air.

The action of brine baths is similar, especially of those which are situated in the mountains, and like Reichenhall and Kreuth, combine an unusual number of curative agents. In addition to the stimulating and hardening action of the baths themselves come the action of deep respirations from climbing in an atmosphere which is free from dust. Methodical exercises in mountain climbing form an extremely efficient curative agent in chronic pulmonary diseases of various kinds, and are so much more efficient, the higher the plateau from which the patient starts, the more rarefied the air and the slighter the atmospheric pressure, and the more free from dust, fog, wind, and rain.

These curative measures come into play, not only in hereditary or acquired predisposition to tuberculosis and scrofula,

but also in manifest pulmonary tuberculosis, the existence of which is placed beyond doubt by the demonstration of tubercle bacilli.

I need hardly tell you now that the tubercle bacillus and its products and effects within the lungs must always stand in the foreground of our reflections. I have already said that the attack upon and destruction of the bacilli, after they have settled in the organism, must be the goal of all our therapeutic endeavors. Unfortunately there is no present hope that this ideal will be reached within a conceivable time. As Fraentzel, one of the best and most reliable investigators in this department, frankly admits, the experiments at the bedside and in the bacteriological laboratory have led to the conclusion that there is at present no hope of destroying the colonies of cocci which have settled in the tuberculous tissues by medication in a gaseous form or in that of substances inhaled in an atomized form.

The best remedies, *i.e.*, those which, according to medical experience, have secured the best results at the beginning of pulmonary tuberculosis are still the physical agencies—air, climate, exercise, water. The question of nutrition is of secondary importance.

In view of the importance of rational and consistent treatment at the onset of the disease, when the hope of recovery is still justified, you must devote all your energies to finding the proper way in each individual case. Hereditary predisposition, the bodily constitution of the patient and his family, age and sex, temperament, mental acquirements, obedience and persistency, social and financial condition—these are factors which vary in every case and therefore make the indications vary. But, however manifold may be the differences which may be distinguished in the individual cases, the curative factors mentioned above possess the same fundamental significance in all and should never be neglected.

The most important is open-air treatment. To a certain extent it may be carried out in all cases, but is naturally modified to a remarkable extent by external conditions. The simplest form is the open window by day and night, constant sitting and lying in the open air, all sorts of simple protective arrangements being provided for unfavorable weather. In addition we prescribe methodical deep inspirations by going

up hills or mountains in the vicinity of the house, certain gymnastics which require deep inspirations, especially on the cross bar, and the other previously mentioned bodily exercises. It is not to be denied that pulmonary hemorrhages may occur during these exercises, but I hardly think that they are more frequent without the exercises than as a result of the more vigorous expansion of the lung.

This holds good with regard to mountain cures, which are open to the well-to-do. There are numerous excellent resorts of this kind for those suffering from pulmonary affections, from places in the lower Alps up to the high plateau of Graubuenden—at all levels we find admirable institutions in which good results are obtained. This favors the view that the altitude itself is not the essential, at least not the sole, source of the curative effects, but that the purity of the air and the pulmonary gymnastics are the most important factors.

If I regard deep respirations in pure mountain or sea air by the vigorous action of the respiratory or other muscles as the chief factor in the treatment of tuberculosis; this is owing to the notion that the colonies of bacilli and cocci will thrive poorly in the depths of the lungs under the constant supply of pure cold air, and that, on the other hand, further colonization may be prevented by vigorous gymnastics of the lungs and active change of pure air. Active ventilation and low temperature of the air must have a favorable action upon the tubercle bacilli, which thrive at a higher temperature and under slight change of air. I leave it undecided whether other factors do not come into play, for example, the stimulation of pulmonary circulation by the deep inspirations, and the expectoration of infectious matters which is effected by vigorous pulmonary gymnastics.

For this reason warm climates seem to me to be less efficient than colder climates, provided the proper atmospheric conditions, especially sunshine and absence of winds, prevail and permit the patient to be constantly in the open air. This is confirmed by the favorable effects of cures in Goerbersdorf, Davos and the high valleys of Graubuenden, the Andes and Cordilleras, in which the patients are in the open air even in winter, by the astonishing effects of Polar journeys upon pulmonary affections, the almost entire absence of tuberculosis in Iceland, the Hebrides, Faroe and Shetland Islands, and the northern parts of Norway.

The correctness of these theoretical considerations of the foremost advocates of open-air treatment is sanctioned practically by the large number of successful results obtained. I mention above all Herman Brehmer, of Goerbersdorf, the founder of open-air and water-cure establishments in elevated localities, who can show great success from the rational and consistent carrying out of his convictions. Also Herman Weber, of London, who, relying upon a ripe experience in hospial and private practice, has for years advocated the rational physical treatment of tuberculosis. The battle between the advocates of free and institute treatment does not concern these principles, but only the manner of their systematic execution. There is no question that the strict treatment of an institute is followed, in general, by better results, because all the bad influences to which an untrammelled guest in a watering place is very often subjected on account of ignorance, thoughtlessness or lack of self-control (pleasure excursions, colds, spoiled stomach) are avoided in institutions under the strict regimen of the supervising physician, while, at the same time, the methodical inhalation of fresh air is guaranteed with all precautions against catching cold, etc.

On the other hand it is not to be denied that the treatment in institutes is terrifying to many, especially to sensitive individuals, and that they feel more comfortable in free health resorts. It is certain that patients who allow themselves to be led by their physician in the right path and are persistent, also show marked benefit in free health resorts, as I have convinced myself with regard to the guests of Reichenhall, Meran and other mountain resorts. If I would desire any other convenience for these admirable resorts, it would be some easily-used mechanical arrangement for protection against wind and draughts, which would enable the patient to sit and lie in the open air, even if the day is somewhat windy. I also miss those contrivances which make it easy to remove bedridden patients, especially those suffering from fever, into the open air (while they remain in bed), and to allow them to enjoy the air in a protected part of the garden. I also deplore the fact that sanitariums are not erected in free health resorts, which are under constant medical supervision, and offer a safe asylum to all patients who are very sick and a protection to feeble characters against their own ignorance.

With regard to the resorts of the Riviera, Sicily, Corsica, and Madeira, it would be unjust to put a low estimate on their advantages and to consider them inferior in curative properties to high altitudes. The wonderful atmosphere and vegetation of the subtropical coast regions of Italy has restored the health of innumerable individuals, or at least prolonged their lives—upon this point there can hardly be two opinions. But not all constitutions experience the same benefits there, and, on the other hand, the conveniences for the sick leave much to be desired. It is true that the apartments in the hotels and private residences are now more comfortable and are provided with good stoves, but on the whole these places are more suited for those who are not very sick and require recreation than for patients who are seriously ill. For the latter, who seek these resorts in such large numbers and pass their lonesome days and nights far from their families and the accustomed comforts of home, the erection of sanatoriums seems imperatively demanded.

So far as regards the amount of atmospheric moisture in the air, to which certain writers attach great importance in the selection of the health resort, we cannot say more, if we remain upon the basis of positive experience, than that a dry climate, in which very little precipitation and fog are found, is more suited in general for tuberculous patients than a moist climate. This is also true of the velocity of the winds. With equal purity of the atmosphere, the dry air of high valleys with the bright sun and slight currents of air is decidedly preferable, because the danger of catching cold from remaining long in the open air is much less, even if the patient is heated from climbing.

The amount of ozone or oxygen in the air, the diminished atmospheric pressure in the higher Alps, have no significance in determining the therapeutic value of a health resort. The celebrated pine woods of some summer resorts, for example, the Black Forest, to whose aromatic exhalations some attribute a sterilizing action on the diseased pulmonary surface, have, in addition to these characteristics, the undoubted quality of dry, warm, and quiet position, which is certainly of great importance as regards the greatest possible enjoyment of fresh air.

It is impossible to exhaust the details of climato-therapy in

such a short space of time. You must study the special advantages of climates and health resorts; and, if possible, learn from actual observation by visiting them. I cannot recommend to you too strongly such personal observation of the conditions in different health resorts.

It remains for me to glance at that portion of the treatment of tuberculosis which the physician is accustomed to carry out in his daily practice and which is therefore no less important to him than to the patient; I refer to the diet of tubercular patients, the treatment of fever and of other disturbances which occur in tuberculosis of the lungs and other organs.

The stage of the disease, the acuteness of its course and the condition of the constitution are decisive with regard to the nourishment of tuberculous individuals. In the beginning, when nutrition has not suffered materially, but the irritability of the heart and tendency to congestions have reached a high grade, a reduction in the amount of albuminoids and a corresponding increase of hydrocarbons and fats are advisable. Vegetable diet acts so much more favorably, the more alkaline bases it contains in the shape of fresh vegetables, fruit, etc., and the more certain its slight laxative action. For this reason the grape cure and whey cure, combined with mountain air, are admirably adapted to this stage. In addition, fresh and cooked fruit, cider and the like appear suitable. Stimulating food and drinks are unsuitable on account of the great excitability of the heart. Coffee, tea, and especially alcohol (only in the form of beer) should only be allowed in small amounts. Kumys and kephir cures are useful even in the first stage, if the patient is in the steppe of Ssamara or can at least live in the open air. Cod-liver oil is also very useful in the beginning if the digestion is good.

In later stages, when the constitution has been impaired by the fever and the appetite has grown poor, it becomes difficult to nourish the patient properly on account of the anorexia. If the fever continues it must be combated in the manner to be described shortly. If the fever is slight and confined to a few hours, the apyrexial part of the day must be utilized as much as possible for nourishing the patient, even at the risk of producing nausea. I am satisfied that the anorexia and dyspepsia do not always depend upon the fever, but, like

the night sweat, may be a pure disturbance of innervation and as such amenable to direct treatment. But too much reliance should not be placed on drugs, although the bitters and aromatic bitters, with or without iron, sometimes act very favorably. The chief importance should be attached to fresh air, especially in the mountains, and out-door exercise, with total relief from business cares, and good, abundant, and varied diet. In selecting a health resort for a consumptive, the kitchen should not be the last consideration, because, even if the appetite is poor, better nutrition is secured by a large number, varied character, and excellent preparation of dishes, than by poor, monotonous fare. This is an important cause of the increase in weight of consumptives in Meran, where an excellent cuisine is found; and also in the Swiss resorts, where a very laudable degree of attention is devoted to the kitchen as well as to all other requirements for a comfortable and pleasant existence.

Debove has attempted to secure the better nutrition of the patient in another way than by the allurements of a bounteous table, viz., by forced overfeeding, *i.e.*, the mechanical ingestion of food through the œsophageal sound or by the natural way by overcoming the repugnance to food. This "suralimentation" undoubtedly has a brilliant temporary effect in many cases, as we have observed in our control-experiments, but after the over-feeding has been continued for several weeks digestive disturbances (development of gas in the stomach and intestines, nausea, diarrhœa, etc.) usually set in as the result of the excessive amount of food in proportion to the gastric and intestinal juices. These compel an interruption of the feeding cure. The symptoms recur in some cases when the plan is again adopted, especially if the large amount of food does not correspond to sufficient destructive disassimilation, particularly to that arising from muscular action.

Weir Mitchell's plan is better regulated and can be carried out longer. Here the ingestion of food takes place during complete rest of the body, but disassimilation is promoted by vigorous massage, which takes the place of muscular contractions produced by the will. Mental and volitional activity is lost in a sort of bodily vegetation, which has an excellent effect upon the economy in many cases, and not alone causes an addition of fat, but also improves the nutrition of the entire nerv-

ous and muscular system, often in an astonishing manner. I recommend Weir Mitchell's plan for those cases of beginning or even advanced tuberculosis, in which there is very little or no fever, but the constitution and appetite cannot be improved because the irritability of the nervous system is excessive. Such neurasthenic (especially female) patients often thrive admirably, despite their tuberculosis, under this feeding cure, which enforces rest, and it not infrequently ushers in a new era of their existence.

In the last few decenniums, alcohol has made its way more and more in the treatment of tuberculosis, and it really deserves an important position. But in the first stage of the disease and in erethistic constitutions, with very excitable heart's action, tendency to hæmoptysis, etc., I advise at least against the stronger stimulants, wine and brandy, and allow only mild beer in small quantities and cider, or forbid all alcoholics and allow milk as the sole beverage. If digestion is good the milk diet often does very well, but this must be inquired into daily in order that no gastric disturbances may develop.

In the later stages alcohol is invaluable and, in accordance with Brehmer's plan, is now given in relatively large quantities (1 to 1½ litre wine, 50 to 60 gm. brandy daily) in all resorts for consumptives. The alcohol especially stimulates the nervous system of the patient, gives him an agreeable feeling of warmth and strength, which is of great value in out-door treatment, especially in cold seasons, improves the vigor and duration of his muscular effort, for example, in climbing, and secures better sleep and amelioration of the night sweats. There are many ways in which alcohol produces these effects. I believe that they depend less on its inhibitory action on disassimilation or its action on the heart, than on the stimulation of the central nervous system, and thus improvement of the functions of all tracts of innervation. The diminution of the profuse night sweats, which are such an annoying result of the weakness of the inhibitory centres of the nerves for the secretion of sweat, and the action on the psychical functions, speaks in favor of the chief effect of the alcohol on the central nervous system.

The quality of the wine may be suited to the taste of the patient, but the heavy red wines, Veltlin, Burgundy, and red

Hungarian wines, have more potency than light white wines. We must individualize both as regards the quantity and quality of the alcohol.

When there is great sensitiveness of the bowels, tendency to diarrhœa, whether tuberculosis of the intestines is present or not, I would recommend the so-called "gluehwein" (red wine boiled with a little cinnamon, sugar, and cloves) as an especially agreeable form of night-cap. The high temperature of the wine and the addition of the spices has an extremely agreeable and anti-diarrhœal effect upon the intestinal mucous membrane. The excellent "grape wine" or "forest wine" of Fromm & Co., in Frankfort, in which the amount of tannin is small, is very useful in the preparation of gluehwein. The "grape wine" is also very serviceable in the unboiled, slightly warmed state. Sensitive patients should never drink cold wine. Moreover red wine does not taste good at a low temperature.

Cognac is usually given in the evening in the shape of cold or warm grog (one to two tablespoonfuls). Some patients present an idiosyncrasy which makes it impossible for them to take cognac; it causes palpitation, insomnia, etc. We must then try arrack or rum, brandy or whiskey, or simply wine.

The treatment of the fever, which is unfortunately too often in the foreground of our therapeutic tasks, is effected in the beginning of the disease and in mild relapses by the out-door treatment and the other dietetic measures. The physicians at health resorts often have the opportunity of observing this satisfactory antipyretic action of the air-cure. Patients who had kept the room for weeks in a state of fever, soon become apyrexial in Reichenhall, Meran, Bozen, or San Remo, recover rapidly from the effects of the fever and not infrequently remain apyrexial during the entire winter. Unfortunately this simple plan does not always suffice, at least in the more advanced stages of the disease. Alcohol, which has a certain antipyretic action, must then be used, also the antipyretics which, whatever may be said against them, cannot be dispensed with. Antifebrin and antipyrin are the best remedies for this purpose. Although they are of little benefit in progressive cases with high fever, they are indispensable on account of the resulting euphoria. In cases of moderate fever their action is often very satisfactory, especially after prolonged use. The patients become able to be in the open air

for a longer time, the appetite increases and sleep is improved. In the last few years I give the preference to antifebrin, which is administered in doses of 0.3 in three to four portions during the twenty-four hours (in capsules). If the beginning of the fever is distinctly marked, for example, by a chill or rigor, we may endeavor to prevent its occurrence by giving 0.6 in a single dose two to three hours before its onset; two doses of 0.3 may then be given in the afternoon or evening. It is well to take a little sherry or Marsala after the drug.

We possess no explanation of the antipyretic action of these drugs. It is most probable that they paralyze the deleterious action of the pyrogenic products of colonies of bacteria, perhaps of secondary cocci, which pass from the lungs into the circulation. Unfortunately they do not seem to be able to prevent the formation of the fever-producing substances.

In some cases the marked development of the fever can be prevented by combating the slightest relapses at once in the same way as is done in relapses of intermittent fever. For this purpose it is indispensable that the patient should take his temperature three to four times every day, and should be weighed every two to three days. It is only in this way that we can distinguish the beginning of the fever from simple malaise and dyspeptic disturbances, and can begin the administration of antifebrin at a sufficiently early period. In some cases the fever only disappears with a change of residence. Lukewarm or warm baths, which are gradually made cooler, with or without the addition of salt, and morning rubbings with diluted brine are often beneficial.

We may also resort to the administration of creosote, which was warmly recommended by Bouchard in 1877, then used with good results by Reuss, Sommerbrodt and Fraentzel, particularly in recent cases with little or no fever. The following favorable effects are mentioned: diminution of the cough and secretion and of the fever, improvement of the appetite, increase in the weight of the body, and finally disappearance of the symptoms of consolidation. Although some cases are unimproved and others do not tolerate the creosote, the majority, according to the authors mentioned, are so favorably influenced that a prolonged trial (one-quarter to one year) should be made in suitable cases, especially when the patients are unable to carry out a methodical air cure, etc.,

either on account of their occupation or their poverty. On account of the bad taste of the drug, it is best given in capsules, each of which, according to Sommerbrodt, contains 0.05 creosote and 0.2 tolu balsam. One or two capsules are taken in a tablespoonful of water after each principal meal, and an interval of four weeks allowed to elapse at the end of every two months. The treatment should be continued for a year or more. Fraentzel gives, according to Bouchard's original formula, 13.5 creosote to ¾ litre sherry with 200.0 spirit. vini rectific. and 30.0 tinct. gentianæ (one tablespoonful two to three times a day in a glass of water).

A. and S. Rosenberg have recently recommended menthol as an antiparasitic, both internally (in doses of 1.0 to 1.5 six times a day) and in inhalations with Schreiber's apparatus for the inspiration of oily substances (15 to 20 drops of a 20% oily solution several times a day). Corroborations of the favorable effects are still wanting.

Other antiseptic substances have been tried in a gaseous or atomized form in inhalations, but these experiments have not furnished any results of practical importance. Thus, the vapor of pine and beech tar, oleum pini pumilionis, turpentine, oil of eucalyptus, etc., have been used. Although no direct curative effects of such inhalations have been proven, their employment is to be recommended in closed rooms in which the patients remain for a long time, especially in bedrooms, since they undoubtedly have a slight antiseptic action, and the diseased parts of the lung which contain not alone tubercle bacilli, but are also subjected to the action of secondary cocci colonies, are reached by them.

Among the other remedies used in tuberculosis we may mention arsenic, long employed in France, England, and Russia. It has been recently recommended in Germany, from theoretical considerations, by Hans Buchner, but has not been approved in practice, at least as a specific. It seems to have good effects as a tonic to the nervous system in certain cases of torpid phthisis.

I can say nothing from personal experience concerning the therapeutic value of inhalations of nitrogen, Bergeon's gaseous enemata of carbonic acid and sulphuretted hydrogen. I fear that both methods, like so many other remedies for phthisis, will soon be forgotten.

With regard to the treatment of secondary tuberculosis and its accidents, I will confine myself to a short description of the treatment used by me in hospital and consultation practice.

Pulmonary hemorrhage is treated with two ice-bags upon the anterior chest wall (including the apex) and by subcutaneous injections of a solution of acid. sclerotin. 1.0 to aq. destil. 5.0 (one syringeful every hour). After the injection the spot is to be thoroughly rubbed, on account of the pain, or a little morphine is to be injected. The solution of sclerotin is much better adapted for subcutaneous injections than a solution of extr. secalis cornuti, which is very painful and may lead to suppuration. I employ the latter, therefore, only for internal use; it should be continued long after the cessation of the hemorrhage, in order to prevent relapses and relieve the fears of anxious patients.

Liq. ferri. sesquichlorati is used in inhalations in solutions of 2.0 : 200. It is not to be supposed that the atomized vapor reaches the bleeding place in the lung and there exercises styptic action. I regard the often excellent effect of the remedy to its vigorous astringent action on the mucous membrane of the upper air passages, which is followed by reflex constriction of the vessels of the pulmonary parenchyma. Starting from this assumption I use the inhalations for a very brief period (one to two minutes) but very often (every half-hour). The amelioration of the cough by morphine injections or the internal administration of morphine is to be decidedly recommended, because each spell of coughing temporarily changes the circulatory processes in the lungs and the patient also dreads the cough as the presumed cause of fresh hemorrhage. Between times the patient is directed to take deep inspirations, which are decidedly favorable to the cessation of the hemorrhage, and he is often allowed to continue these deep inspirations for a long time, after being convinced of their harmlessness.

Tubercular ulcers of the larynx, pharynx, and tongue can very rarely be healed; this is most apt to occur in the larynx in cases of circumscribed chronic ulcerations. The extensive superficial ulcerations of the final stage give an absolutely unfavorable prognosis and require simply palliative local treatment with anæsthetics, particularly cocaine, and salts of

bromine. In the chronic laryngeal ulceration of the early stage, I advise against active remedies, especially caustics, such as nitrate of silver, etc., and recommend applications of mild antiseptics, boric acid, potassium chlorate, creosote, lactic acid, or menthol.

In tuberculosis of the intestines it is necessary to combat the diarrhœa. This, together with the accompanying abdominal distress, is best treated by opium, but for prolonged use it is preferable to administer astringents, tannin and nitrate of silver, but especially the mild tannin-containing drugs (columbo, rhatany, quinine, kino) or the antizymotics, such as naphthalin. In addition, warm spiced wines, such as the gluehwein mentioned above, grape wine, also oatmeal soup or barley grits, and warm, dry or moist compresses to the abdomen.

A very distressing complication for the poor patient is the extremely disagreeable periproctitis with its termination in complete or incomplete rectal fistula. That the inflammation of the connective tissue around the rectum stands in a causal relation to tuberculosis, especially of the intestines, is beyond doubt, since Schuchardt and Krause have demonstrated tubercle bacilli in the granulations of the abscess cavity, and the infectiousness of the granulation tissue was shown by successful inoculations into the anterior chamber of the eye of rabbits even in cases in which bacilli were not found. In view of the rarity of tubercular ulcers of the rectal mucous membrane the direct infection of the periproctal connective tissue must be attributed to the action of bacilli-containing fæces on small epithelial fissures or erosions, resulting from the prolonged stay of the fæces in the rectum. But we cannot dispute the possibility that the bacillary process in the periproctal cellular tissue may develop through the medium of the circulation and independently of processes on the rectal mucous membrane in a manner analogous to the development of the fistulous cutaneous ulcers of scrofula. But it is much more plausible that the infection occur from the cavity of the rectum or its bacilli-containing contents, and this view is accepted by Schuchardt in his latest publication.

The favorable results of the radical operation (division, curetting, actual cautery) of these rectal fistulæ (which were shown to be undoubtedly tubercular by the presence of bacilli or successful inoculation) are a new and gratifying proof of

the curability of local tuberculosis, and speak in the strongest terms against the old surgical doctrine that the rectal fistulæ of tuberculosis should be regarded as a *noli me tangere* because the tuberculosis develops at once in other organs after the operation. These fistulæ should be operated upon as early and as radically as possible. Tuberculosis in other localities will then develop as little as it does after the early extirpation of a tuberculous lymphatic gland or the operation for a fungous knee-joint.

I have for a long time observed several cases of chronic tuberculosis in which a tubercular rectal fistula was successfully operated several years ago and in which the tuberculosis has not advanced since the operation.

You see, Gentlemen, that the therapeutic field of pulmonary consumption is very extensive. On many points I could merely touch. I would gladly discuss tuberculosis of the glands, the serous membranes, brain, kidneys, skin, bones, and joints, but I must also pay some consideration to the time allotted me, and will reserve the discussion of these affections for a future lecture.

PSYCHO-THERAPEUTICS;

OR,

TREATMENT BY HYPNOTISM.

BY

C. LLOYD TUCKEY, M.D.

PSYCHO-THERAPEUTICS.

CHAPTER I.

In bringing forward this little book on Treatment by Suggestion, I feel that, though I must crave indulgence for the shortcomings of the writer, no apology is necessary for introducing so important a subject.

The Nancy treatment has during the last few years attracted so much interest among men of science and members of the medical profession on the Continent, that it seems strange the knowledge of it in this country is almost entirely theoretical. The system of psycho-therapeutics has so far attained its fullest development in Holland, where in every large town it is followed by at least one well-qualified practitioner; while in Germany, Russia, Sweden, and indeed every European country, its position is secured by the support of leading physicians, and by the success attending their practice. In every country, I believe, the introduction of the system was at first opposed by persons who feared the popularization of so potent an agent; but as the beneficial results of the treatment became manifest, opposition decreased, and has now almost died out. This is doubtless due chiefly to the fact that the treatment has not been allowed to fall into the hands of ignorant and unqualified practitioners, but has been accepted by men of high character and professional repute. The dangers of hypnotism have been proved chimerical; in proper hands no undesirable medical results can occur through its practice, and there is, I believe, hardly one authenticated case of its being used for a criminal purpose in the countries where it is most frequently employed by medical men. More than this can hardly be said for any system of medical treatment.

But while maintaining that hypnotism has been very little

used for criminal purposes, we should be foolish to blink the fact that it *might* conceivably, under certain circumstances, be a dangerous weapon in unprincipled hands, and that its injudicious use *might* lead to physical and mental ills; but such evil results are in a very great measure preventible. Wherever hypnotism has been largely adopted as a valuable aid in the treatment of disease, its importance has been formally recognized, and its employment by charlatans, either as a toy at public exhibitions, or in unauthorized medical practice, has been prohibited by law.

Medical electricity is only now emerging from the limbo of quackery, because for years the medical profession allowed it to be exploited by "professors," who used it as a universal remedy in all cases, suitable and unsuitable. The Nancy system has been successful on the Continent because it is practised there by qualified physicians and surgeons, whose knowledge and experience has taught them where the treatment would be likely to succeed, and where it would prove ineffectual. I here advocate its use not as a universal remedy or as a supplanter of ordinary medical treatment, but as a powerful auxiliary in combating many forms of disease not readily reached by other means.

It is now nearly thirty years since Dr. Liébault began to treat patients in a public dispensary at Nancy by a new system, which he gradually elaborated, and caused to be known as "Treatment by Suggestion."

In 1866 he published a book on the subject, in which he gave to the world a full description of the means used by him and an account of cases successfully treated.[1] But little notice was taken of it at the time, and even in Nancy, where Dr. Liébault lived a retired life, devoted to the poor among whom he practised, he was regarded as, at the best, an amiable but mistaken enthusiast. In 1882, Professor Bernheim, of the Faculty of Medicine at Nancy, began to investigate the system, quite as a sceptic, so he tells us, and, being soon convinced of its value, introduced it into his hospital clinique. In 1884 he brought out his classical work on suggestion.[2]

Dr. Bernheim was well known in the medical world, and his book attracted general attention on the Continent. His example was soon followed by other physicians and writers of eminence, among them Professors Beaunis[3] and Liègeois,[4]

of Nancy, Delbœuf,[5] of Liége, Burot and Bourru, of Rochefort, Fontain and Sigard, of Bordeaux,[6] Forel, of Zurich; and Drs. Despine, of Marseilles, Van Renterghem and Van Eeden, of Amsterdam, Wetterstrand, of Stockholm, Schrenck-Notzing, of Leipsic, etc. The literature of the subject published in French alone during the last five years would make a fair-sized library; and almost every large town on the Continent has its practitioners of the system, who nearly all have written about it more or less extensively. Also, a journal[7] is published monthly in Paris, in which its latest developments are fully described and discussed.

So far as I know, there is in English no literature on the subject treated therapeutically. From time to time articles have appeared in the medical and scientific journals, especially in "Brain" and "Mind," alluding to its progress abroad, and giving reviews of some of the foreign books relating to it. The Psychical Society have investigated the phenomena of suggestion from a purely scientific standpoint, and Dr. Hack Tuke led up to its very threshold in his deeply interesting work.[8]

To James Braid, the Manchester surgeon, is due the credit of having seen the germs of truth which lay hidden and obscured in the writings of Mesmer and the animal magnetizers. He attempted to explain by physical laws the effects produced by mesmerizers,[9] and he ridiculed the notion of there being any such thing as a magnetic fluid or current. His disgust for the mysticism of mesmerism drove him, perhaps, too far toward the other extreme, and made him more rationalistic than the facts warranted him in being. Although he publicly demonstrated his system of healing—which he practised with much success—and wrote several works upon the subject, it appears to have died with him, and it remained for Dr. Liébault to arrive at the truth of psycho-therapeutics.

I believe that all great discoveries are led up to by previous half-discoveries; and it does not detract from Dr. Liébault's credit that he started with a large amount of evidence on the subject collected by earlier observers, any more than Darwin's claim to be the first evolutionist is weakened by his having drawn on the material supplied by Lyell, Hooker, and a multitude of others. Liébault's genius taught him to arrange and systematize the facts collected by his predecessors, and to

find the true explanation of phenomena which they had misunderstood. And his patience and steadfast courage led him to persevere in his work, undeterred by opposition or neglect, until now we find him the founder of a school which, as I have said, has its representatives all over the Continent—acute and clear-sighted men of science, of a class quite unlikely to entertain the fanciful theories of mesmerism, on the one hand, or those of "faith healing," on the other.

CHAPTER II.

ALL who have given any attention to the subject acknowledge what immense power the mind—acting in conjunction with or apart from the will—has over the body, forcing it at times to unusual or even extraordinary effort. This power is exercised both in health and disease, but is peculiarly evident —perhaps because it is more closely observed—in the latter condition. Every one, physician and psychologist especially, knows some curious instances illustrative of its effects: such as the story of the hospital patient to whom the consulting physician gave a prescription, with the remark, "Take this, it will do you good." At the man's next visit, he, being asked for the prescription, replied that he had swallowed it as directed, and it had, according to promise, done him "a power of good." Dr. Hack Tuke (op. cit.) gives a number of cases in which drugs have acted not according to their proved properties, but according to the expectation of the patient. For instance, a student having asked for an aperient pill, the dispenser by mistake gave him one composed of opium and antimony, which, instead of producing the usual effect of inducing perspiration and drowsiness, acted in the way the student expected. Every medical man can quote examples of this sort from his own practice, and if sometimes he is wrongfully accused of having produced baneful effects, he is indemnified at others by having marvellously good results ascribed to very simple measures.

There are few cases of this kind more remarkable than one related by Mr. Woodhouse Braine, the well-known chloroformist. Having to administer ether to an hysterical girl who was about to be operated on for the removal of two sebaceous tumors from the scalp, he found that the ether bottle was empty, and that the inhaling-bag was free from even the odor of any anæsthetic. While a fresh supply was being obtained, he thought to familiarize the patient with the process

by putting the inhaling-bag over her mouth and nose, and telling her to breathe quietly and deeply. After a few inspirations she cried, "Oh, I feel it; I am going off!" and a moment after her eyes turned up, and she became unconscious. As she was found to be perfectly insensible, and the ether had not yet come, Mr. Braine proposed that the surgeon should proceed with the operation. One tumor was removed without in the least disturbing her, and then, in order to test her condition, a bystander said that she was coming to. Upon this she began to show signs of waking, so the bag was once more applied, with the remark, "She'll soon be off again," when she immediately lost sensation, and the operation was successfully and painlessly completed. This girl had taken ether three years before, so that expectation and the use of the apparatus were sufficient to excite her recollection, and call back the effects of the drug as then experienced.

It is told that when Sir Humphrey Davy was investigating the properties of laughing-gas—as nitrous oxide was then called—he proposed to administer it to a man who was suffering from tic douloureux, but before doing so he tried his temperature by putting a thermometer into his mouth. The man took this instrument for some new and subtle remedy, and in a few minutes exclaimed that the pain was cured. The same belief in the efficacy of the thermometer remains to this day among the uneducated, as a friend of mine found to his cost when he was hospital-clerk to a well-known physician. It was his duty to take each morning the temperature of every patient; but on one occasion, being pressed for time, and knowing by experience that a certain patient's temperature was always normal, he saved a few minutes by leaving it untried. Later in the day, when the physician asked this man how he felt, he replied that he was much worse, as might be expected considering the way in which he was neglected. On inquiry it came out that the potent charm of having the glass tube in his mouth for three minutes had been omitted, and my friend got a reprimand.

While in Jamaica, I knew a young lady who had for months been confined to her bed or couch, unable to walk a step, from apparent paralysis of the lower extremities, which entirely defied the treatment used. One morning news was brought to her that her brother, to whom she was devotedly

attached, had fallen from his horse, and was lying in a critical condition some miles away in the mountains. She immediately got up, herself helped to saddle a horse, rode to the scene of the accident, and nursed her brother night and day for a week. She was completely and permanently cured of the paralysis, which of course was merely functional and hysterical, by the nervous shock which had brought her will into operation.

A somewhat similar case came under my observation some years ago. A clergyman in whose house I was staying had long been a sufferer from chronic rheumatism, through which he was so disabled that he could only walk very slowly and with great inconvenience. On this occasion he was lying on a sofa, from which he could see through an open door and across a hall into another room, where his wife happened to be. By some careless movement she upset a table there, and, as if by magic, he sprang to his feet and walked rapidly and with a perfectly even step into the opposite room, exclaiming, "There goes all the ink that was in the house, and I have to write my sermon!" In this instance, however, the cure was as ephemeral as the emotion which had caused it; but it is not improbable that a continued excitement might have prolonged the power of easy motion, and so have broken down and caused absorption of the adhesions and exudations which produce the pain.

At a water-picnic some months ago, a young lady complained of terrible neuralgia. From some cause the boat began to rock violently, and she became extremely nervous. Her fear of being upset completely drove away the neuralgia, which did not return, at least on that occasion. It is known that sufferers from sea-sickness almost invariably become quite well in moments of danger; and we can often lose the sense of pain by occupying our minds with some affair of great interest.

On the other hand, it is possible for an apparently quite healthy person to develop, by pure imagination, the symptoms of serious illness. Laymen who dabble in medical science, and medical students at the beginning of their course, are apt to image that they have one or other of the diseases they have been studying—heart-complaint being perhaps the most usual; and of this they do frequently develop some of the subjective symptoms.

A friend of mine tells me that once only in his life has he suffered from laryngitis and loss of voice. This was while attending Dr. Semon's lectures on diseases of the throat. It may have been a mere coincidence, but that hardly explains the frequent instances of medical men who have succumbed to the disease which they have made their special study, *e.g.*, Professor Trousseau from cancer of the stomach. It is probable that the mind being continuously fixed on one special organ, predisposes to disease of that organ.

Hypochondriasis is, as we know, a condition in which the patient feels the working of his internal organs, and is morbidly conscious of them. It tends to grow worse, because his attention becomes more and more fixed upon functions which ought to be performed automatically, and unless some powerful mental stimulant is applied, organic disease is sometimes actually set up. There are many people, of both sexes, who never hear of a disease without fancying they have it. The illness of a royal or distinguished sufferer, the progress of which is daily recorded in the newspapers, will sometimes become almost epidemic; thus throat specialists can tell some curious stories of the increase of imaginary and real throat-affections during the illness of the late Emperor Frederick; and a short time ago, it will be remembered, measles became for a while a fashionable malady. That fear will promote disease has been abundantly proved during outbreaks of cholera, small-pox, the plague, and other epidemics. Pseudo-hydrophobia is a recognized malady, and no doubt many supposed cures of hydrophobia have in fact been cures of this fear-induced imitation.

We sometimes come across people who tell us they "have no time to be ill;" and certainly reports of longevity show that rust destroys more than use, and that hale old age is more frequently attained by those who have led busy lives than by idlers. Idleness is a well-known factor in producing all kinds of ailments, real and imaginary, of mind and body, perhaps because the idle man, from sheer lack of interest in life, devotes too much attention to his own organism.

Imagination, combined with "direction of consciousness" (Sir H. Holland) to a part, will produce results which have been noticed by many pathologists. John Hunter said he was confident of producing a sensation in any part of his body

simply by concentrating his attention on it. Sir H. Holland observes:[10] "In hypochondriasis, the patient, by fixing his attention on internal organs, creates not merely disordered sensations, but disordered action in them." And again: "When there is liability to irregular pulsation (of the heart), this is brought on and increased by a simple effort of attention."

A medical friend of mine, who is affected with insufficiency of the mitral valves, tells me that he is hardly ever inconvenienced by it, except when he has to examine a patient with heart-disease. His attention is then drawn to his own weakened organ, and he suffers from palpitation.

Dr. Forbes Winslow, speaking on this subject, says:[11] "It is a well-established fact that alterations of tissue have been the result of a morbid concentration of the attention to particular organic structures. Certain feelings of uneasiness or even pain originate in the mind a suspicion of disease existing in particular parts of the body, it may be in the lungs, stomach, heart, brain, liver, or kidneys. Some slight irregularities and functional disturbances in the action of these organs being noticed, are at once suggestive (to the hypochondriac) of serious and fatal disease being established in the part to which the attention is directed. This deviation from a normal state of certain functions frequently lapses into actual *structural* disease, as the effect of the faculty of attention being for a lengthened period concentrated on this action. The continuous direction of the mind to vital tissues *imagined* to be in an unhealthy state undoubtedly causes an exaltation of their special functions, and an increase of susceptibility, by (it may be presumed) concentrating to them an abnormal quantity of blood, this being followed successively by (1) undue vascular action, (2) capillary congestion, (3) an excess in the evolution of nerve force, and (4) appreciable *structural* alterations." Dr. Hack Tuke says:[12] "If twenty persons fix their attention on their little finger for ten minutes, the result will be that most of them will feel decided sensations there, amounting in some to a mere sense of weight or throbbing, and in others to actual pain." He endeavors to explain this by supposing that the act of attention excites an increased flow of blood to the part, and consequent increased vascularity of the sensory nerve-ganglia, so leading to subjective sensation; or that the sympathetic nerve-centres become excited, and the vaso-motor

nerves influenced thereby so as to cause in the finger temporary vascular changes which invoke sensation. He puts forward also a third hypothesis, which is interesting from the relation it bears to that given by Professor Delbœuf, of Liége (see page 788)—that fixing the attention on a part of the body for some time renders us conscious of the working of functions which are usually performed automatically and unconsciously. Sir James Paget thinks that by nervous excitement the temperature may be raised to at least 101° (from the normal 98½°); and Professor Wunderlich says on the same subject:[13] "In hysterical neurosis elevations of the temperature even to excessive heights may occur without any motive at all." Dr. Wilkes relates cases of extreme anæmia caused by depressing emotions; and this agrees with the experience of all medical men, as does also the opposite observation, that pleasant emotions bring about a good state of the blood and secretions, and improve the health. Instances in which the hair has rapidly, even in a few hours, suffered atrophic changes, leading to its becoming white and falling out from excessive depressing emotions, are common; and under similar circumstances the teeth will sometimes rapidly decay.

Dr. de Watteville says:[14] "One of the most striking properties of the nervous system is that by which the activity of one portion may be arrested or prevented—'inhibited'—by the activity of another . . . when we attend closely to a sensory impression or to a train of thought, the excitability of every part of the brain, except that actually engaged in the act, is diminished by an inhibitory action of the working portion. Thus when we say that anger or fear paralyzes, we allude in very accurate language to the inhibitory influence which powerful emotion exercises on the cerebral functions." That emotion and fancy have power to modify the secretions is shown by the well-known fact that the mouth becomes dry and parched through fear or anger, while on the other hand it "waters" at the idea of savory food; the mental impression paralyzing or stimulating the secretory apparatus of the salivary glands. Violent emotion, again, will so modify the secretion of gastric juice as to cause indigestion in subjects at all predisposed to it. An attack of jaundice may be induced by anger—as the popular saying, "Green with rage," implies—from an accumulation of bile in the blood through nervous

excitement causing "inhibition" of the secretory function of the liver.

Disease, then, as we have seen, may, in hypochondria and kindred states, be induced by *auto-suggestion*, and there is no doubt that it may likewise be induced by suggestion from without. Let a man be told repeatedly by his friends that he is looking ill, that he does not seem fit to go about, that he must take care of himself, or he will have this or that complaint—and unless he has a very cheerful and well-balanced mind, he is pretty sure, for a time at least, to deteriorate in health. There is a story of such suggestions being made, for a practical joke, at the expense of a stalwart farmer, who, having been assured by several persons that he seemed in a bad way, did really take to his bed and go through an unmistakable attack of illness. This of course was a cruel and unwarrantable jest—yet a somewhat similar effect is occasionally produced by well-meaning persons, who are in the habit of commiserating their acquaintance for not looking well.

Dr. Hack Tuke gives an instance of death itself being produced by suggestion. A Frenchman of rank was condemned to death for some crime, and his friends, willing to avoid the scandal of a public execution, allowed him to be made the subject of an experiment. He was told that he must be bled to death. His eyes were bandaged, and his arm having been lightly pricked, a stream of warm water was made to trickle down it and fall into a basin, while the assistants kept up a running commentary on his supposed condition. "He is getting faint; the heart's action is becoming feebler; his pulse is almost gone," and other remarks of the sort. In a short time the miserable man died with the actual symptoms of cardiac syncope from hemorrhage, without having lost a drop of blood. (Appendix, note 1.)

There are some authenticated cases of apparent death being produced by auto-suggestion. We hear of this being accomplished by Indian fakirs and other religious enthusiasts in Eastern countries. Braid cites a remarkable, and, he believes, thoroughly well-authenticated instance of a distinguished holy man, who, to convince an incredulous Indian prince that he possessed this power over himself, apparently died, and was laid in a sealed coffin within a vault, the entrance to which was also sealed and guarded by soldiers. After six weeks, the

time appointed by himself, he was taken out of the tomb in the presence of the Rajah and of several credible witnesses, English as well as native, and found to display every appearance of death. Having been gradually revived by his own servant, the still ghastly-looking, corpse-like creature sat up and spoke, his first words being addressed to the doubting Rajah: "Do you believe me now?"

The best warranted European case of the sort is that of Colonel Townshend, related as follows by Dr. Cheyne: "He could die or expire when he pleased, and yet, by an effort or somehow, he could come to life again. . . . We all three felt his pulse first; it was distinct, though small and thready, and his heart had its usual beating. He composed himself upon his back, and lay in a still posture for some time. While I held his right hand, Dr. Baynard laid his hand upon his heart, and Mr. Skrine held a clean looking-glass to his mouth. I found his pulse sink gradually, till at last I could not feel any, by the most exact and nice touch; Dr. Baynard could not feel the least motion in the heart, nor Mr. Skrine discern the least soil of breath on the bright mirror. Then each of us by turns examined his arm, heart, and breath, but could not, by the nicest scrutiny, discover the least symptom of life in him. We reasoned a long time about this odd appearance, and, finding he still continued in that condition, we began to conclude that he had indeed carried the experiment too far; and at last we were satisfied that he was already dead, and were just ready to leave him. This continued about half an hour. . . . As we were going away we perceived some motion about the body, and, upon examination, found his pulse and the motion of his heart gradually returning; he began to breathe heavily and speak softly. We were all astonished to the last degree at this unexpected change." (In the article on "La mort simulée" ["Dict. Encyclop. des Sciences Médicales," Paris, 1875], Dr. G. Tourdes refers to some similar cases, and endeavors to explain them scientifically.)

As sickness, and perhaps even death, may be produced by suggestion, so may be, and very often is, produced the cure of sickness. Toward this, however, auto-suggestion, though it might do much, does actually little or nothing, the natural reason being that the mind of a sick person, when left to itself, is prone rather to suggest morbid than health-inducing ideas,

and so operates for mischief rather than in the direction of cure. Every physician knows how, by determined hopefulness and cheerfulness, a sufferer from functional, and even from curable organic disease, may facilitate the work of healing, and materially hasten his recovery.

In all ages wonderful cures, real amid a multitude of shams, have been wrought at holy places dedicated to various saints of various cults. Among the throngs of pilgrims to Mecca, to the sacred rivers and temples of India, to the shrines of Buddhist hagiology, there are some who, having made the outward journey wearily and painfully, do indeed turn homeward with the gift of health. A proportion of those who have limped or been carried to Lourdes and to a hundred other holy places of the Catholic Church, do leave behind them crutches that they no longer require. Some of the sufferers who worshipped the Holy Coat at Trèves, did truly receive in restored health the reward of their faith. Some wearers of relics and amulets are really the better for possessing them. The cheered, uplifted, and convinced mind works, sometimes with startling rapidity, on the diseased body.

For this same reason, touching for the king's evil did no doubt effect many cures. The royal progresses were announced some time beforehand, and the sufferers along their route had often weeks in which to cherish the expectation of healing, in itself so beneficial; and in those days of faith, when a belief in the divine right of kings was universal and strong, the touch of the royal hand must, except in the most hopeless cases, have had a stimulating effect which may often have caused a healthful reaction. Even in our own times, a royal touch, accompanied by kindly words, has good effect. We read in the life of Victor Emanuel,[15] that in 1865, when the cholera was raging in Naples, and the panic-stricken inhabitants were migrating by thousands from the city, the king, wishing to give his people courage, went the round of the hospitals. "He stood beside the sick-beds, and spoke encouragingly to the patients." Before one of those already marked for death, the king stopped, and taking his damp, frozen hand, he pressed it, saying, "Take courage, poor man, and try to recover soon." The warm grasp of the hand, the strong cheerful words, the recognition of the king's face, had an agitating effect on the dying man. That evening the syndic

visited the king, and said: "Your majesty's coming is a joyful omen. I am happy to tell you that the doctors report a diminution of the disease in the course of the day, and your majesty has unawares worked a miracle. The man you saw this morning stretched for death is out of danger this evening. The doctors say the excitement of your presence caused the salutary crisis." In Carpenter's Physiology [16] numerous examples are given demonstrating the influence of the mind and imaginative faculties on the different bodily functions, and we have only to consider a moment to recall many personal experiences pointing in the same direction. (My friend, Dr. Roth. the well-known pioneer of Ling's Swedish gymnastics in England, to whom I owe my introduction to Dr. Liébault and his system, tells me he has been using suggestion without hypnotism all his life, and we know that a main object of Ling's method is to evoke the patient's dormant will-power.)

CHAPTER III.

I HAVE endeavored to show how much the imagination (in its widest sense) may have to do with our health of mind and body; and I shall now try to point out that the effects of "directed consciousness" are greatly increased under certain conditions, when the mind is so withdrawn from the consideration of all extraneous ideas as to be absolutely concentrated upon one object.

We have seen how concentration of mind-faculty, whether self-induced or brought about by some shock to the system, or some powerful external influence, can modify functions, and both produce and cure disease—sometimes gradually, but often, in the case of shock or sudden and overpowering influence, with a rapidity which seems almost miraculous.

We all know, and frequently by our own experience, that mind-concentration, brought about by some strong motive, will enable us to perform mental or bodily actions of which we would generally be incapable. Through it a man will achieve feats of strength far beyond his apparent muscular power, or will go boldly through dangers from which he would shrink if he paused to consider probable consequences. Or he will, in a limited time, execute a prodigious amount of intellectual work, possibly of such startling excellence that he himself, in after-moments of less intensity, will be amazed at his own performance. Of course concentration, if sustained at such a pitch, would in time be the ruin of mind and body; but we know that it is a necessary factor in the accomplishment of all great things, and that there can be no success in life for those who cannot command it to a moderate degree. Of this, we see a striking instance in Coleridge, who, with all his wonderful genius, brought a surprisingly small quantity of work to completion, for want of this mind-directing power. The less we have of it, the more our mental action tends to become automatic. The mind of a person unused to exercise it, drifts

undirected and undisciplined from one idea to another; he can hardly follow a line of thought to its conclusion, and his talk, and probably his actions, will be as inconsequent as his wandering fancies.

As a rule, happily, the organic functions which carry on life are purely automatic; but, as we have seen, it is possible to concentrate the attention upon them, and so affect their operation, sometimes beneficially, but far more commonly with detriment to the health of mind and body. Those bodily movements over which we have full control are also generally performed automatically. Under ordinary circumstances, we give no conscious thought to our steps in walking, to the motion of our hands while at work; these are nearly as automatic as healthy breathing. So, likewise, in a general way, is the operation of the senses. We see, hear, feel without any effort of our will, unless some special motive impels us to exercise it. We concentrate our minds upon sight when we strive to see a minute, or indistinct, or distant object; and upon hearing when we listen for a faint or eagerly-expected sound. If such concentration is continuously brought to bear upon any sense, it will in time convey automatically the more intense impression which has been exceptional. Thus, in savages and in travellers and settlers in wild or dangerous regions, the senses of sight and hearing are far more keen than in those who live under civilization. The senses of touch and hearing become exquisitely fine in the blind. A blind man will sometimes hear sounds which are absolutely inaudible to ordinary ears, and recognize objects by touch as correctly as most people can by eyesight. Some blind persons seem, through concentration, to have developed a sense of space. On entering a room they can tell whether few or many persons are present; they can guess with wonderful accuracy the size and shape of an inclosed place, and have a curious power of avoiding any obstruction, such as an article of furniture which may be in their way. (Most people have probably noticed that closing the eyes will, for the moment, render the hearing and touch unusually acute. Any sense may be intensified by mind-concentration, as in the case of tea and wine tasters, and of professional buyers of raw silk, who develop an unerring capacity of judging its quality by touch.) Deaf people often develop the sense of sight to an extraordinary extent.

By concentration of this faculty they are able, as we know, to follow a speaker by watching his expression and the motion of his lips. Their sense of touch also becomes more delicate; and occasionally they are able to enjoy music by feeling the vibration of air set in motion by its sound.

Concentration of mind upon intellectual or physical action is usually possible only in our waking and wakeful moments. Fatigue of brain renders us incapable of it; and in sleep, the natural consequence of such fatigue, we generally lose consciousness, and only exercise those functions which are performed automatically. In dreams consciousness is once more aroused, and we may even use some reasoning power, and be influenced from without through our senses. But in ordinary dreams there is no concentration of ideas upon an act to be performed or a goal to be reached. When a sleeper uses this effort of mind, he passes out of the region of dreams, and enters that of somnambulism.

The somnambulist never has that semi-consciousness of his state, and of the unreality of his fancies, which sometimes exists through a dream—when the sleeper *knows* that he is dreaming, and will even try to prolong his vision if it be delightful, and dispel it if painful. Such an exertion of will is impossible in somnambulism. (In dreams, doubtless, it is possible only when the sleeper is close upon waking.) In this state all fancies *must* appear realities. The imagination is, as I have said, concentrated upon one object, and so completely that actions are as effectually performed as if directed by strong will-power. But an onlooker can easily perceive, by the expression and posture of somnambulists, that the discerning and judging faculties are in abeyance.

In somnambulism actions of extraordinary difficulty, such as could not be performed by the sleeper during his waking hours—except, perhaps, through mind-concentration caused by some overpowering impulse or motive—are accomplished with perfect ease. Persons in this condition will walk on the extreme edge of a precipice, climb dangerous heights, get out of a house through an upper-story window. There are numerous instances of this on record, of which I will quote two or three. Dr. Paul Garnier[17] gives one of a patient, a dentist's assistant, of feeble bodily and mental health, who frequently fell into a state of somnambulism. On one of these occasions

he escaped by a window from the ward of the Hôtel Dieu, in which he was undergoing treatment, and, though a peculiarly unathletic person, walked easily and fearlessly along the sloping parapet of the façade—a feat which a trained gymnast could hardly have accomplished. He awoke in the course of this dangerous performance, and had to be rescued by means of a ladder. With the return of consciousness reason awoke, and he understood the horror of his position. While blindly obeying his impulse he had acted automatically, and fear, which is a product of reflection and association of ideas, had no existence for him. (Infants, in whom of course neither is possible, will, if allowed, grasp at the flame of a candle, or a sharp instrument; and young children will fearlessly put themselves into positions of great danger.)

A patient of my own, a young man twenty years of age, not an habitual somnambulist, but a sufferer from nightmare produced by chronic dyspepsia, on one occasion, while spending the night in an hotel, dreamed that he was confined in a dungeon from which he must escape. The dream no doubt passed into somnambulism, for under its influence he broke his iron bedstead—a feat of strength which, waking, he assuredly could not have accomplished—and tore up his bed-clothes. His amazement was great when he awoke in the morning amid the ruins of his own creation. He remembered his dream, but had no recollection whatever of the acts into which he had been led by it.

Dreams thus merging into somnambulism may produce tragic results. Dr. G. Tourdes[18] relates how a man sleeping beside his wife dreamed that she was a robber whom he must kill. He accordingly attempted to suffocate her with a pillow, and it was with great difficulty that she succeeded in awaking him, and so saving her life.

In 1843 a young man was tried for the attempted murder of an innkeeper at Lyons.[19] He had arrived at the inn toward nightfall, and was allotted a room. In the dead of night loud cries were heard from this room, and the landlord, rushing in to see what was the matter, was set upon by his guest and seriously wounded. It was ascertained that the young man was a somnambulist, who had dreamt that the landlord was murdering the occupants of a room near his own, and that he was defending them. He was, of course, acquitted.

We have many instances of mental work being accomplished during somnambulism. Professor Wœhner[20] of Gottingen, after vainly trying for several days to write a Greek poem on a given subject, composed it successfully while in this condition, which probably was brought about by the mental strain of his previous futile efforts. (Coleridge's poetical fragment, "Kubla Khan," was probably composed in a dream —not in somnambulism—as he remembered and wrote it down on awaking.)

A clear case of somnambulism was that of a clergyman, whom his wife saw rise from bed in his sleep, go to a writing-table, and write rapidly for some minutes. This done, he returned to bed, and slept on until morning. On awaking, he told her that in a dream he had worked out an argument for a sermon, of which he now retained no recollection whatever. She led him to the writing-table, and showed him the written sheet, upon which he found his argument worked out in the most satisfactory manner.

It rarely happens, however, that solutions of problems, poems, etc., written by persons in this state, have any value. They may begin well, but generally drift into nonsense, probably because the mental concentration has been dispelled by some new idea crossing the first, and displacing it.

Habitual somnambulism may be natural—that is, may exist without any actual disease, though it is hardly ever found in persons of robust bodily and mental constitution. It is not uncommon in delicate or nervous children and young persons, but if with advancing years the mind and body gain strength, the tendency to it is likely to decrease and finally disappear. *Accidental* somnambulism is directly produced by illness or mental strain, and may occur in normally healthy persons of great intellectual power. When the state is habitual or frequent, the somnambulist may be said to lead two lives, one almost distinct from the other, and to have two entirely unconnected memories. Memory, as we generally understand it, is dormant during somnambulism. The sleeper remembers nothing that has occurred during his waking hours, and, when he again awakes, has no recollection of his actions during the somnambulistic state. Yet, in his next attack of somnambulism, the memory of these is likely to come back to him.

The effect of natural or accidental somnambulism on the health is anything but beneficial. An attack is generally followed by feelings of weariness and discomfort, for which the subject is at a loss to account. The concentrated mind-power does not operate in a beneficial direction, but impels the sleeper to bodily or mental effort likely to have an exhausting and hurtful effect upon him. But the artificially-produced mental condition seen in hypnotism can be turned to therapeutic uses, and be made to fill a void which no other plan of treatment can reach. Dr. Bernheim considers hypnotic sleep analogous to the natural state, with the important difference that in natural sleep the subject is only in relation with himself, whereas in the artificial state he is in relation with the operator, who is therefore able to direct the thoughts into the channel he wishes. That it resembles natural sleep is proved by the fact that it is possible in certain cases for one to pass into the other. Dr. Van Eeden told me that a patient of his, a gentleman, wearied by long waiting and exhausted by the heat, fell asleep in the waiting-room. The doctor came in, and, seeing him asleep, said, "Don't wake, but come with me into my consulting-room." The patient got up and, with assistance, did as he was desired. After the treatment was over he was led back in the same way to his former seat in the waiting-room, and allowed to finish his sleep. He soon awoke, apologized to the other patients for having slept, and expressed surprise that his turn had not yet come for seeing the doctor. Great was his astonishment when he was told that the séance had taken place and was finished without his knowing anything about it. Dr. Maury,[21] who cannot be accused of being too easily influenced, gives some instances in which, while sitting by his fireside dozing after dinner, he had heard, as in a dream, the words uttered by his wife and friends, and had followed out the train of thought suggested by them in his dreams, and had even acted upon suggestions so made. (He relates how, on one occasion, he was sitting in his easy-chair half awake, when his wife spoke to him. He was awakened by the words, and remembered them, but was quite unable to tell whether he had uttered them himself, or whether they were his wife's. On this he remarks, "How many actions and ideas are daily suggested to us by others which we act upon, thinking they are our own!") If a person

is very tired it is frequently possible to obtain an answer to a question whispered in his ear without awakening him. Dr. Hack Tuke and Mr. Braid give several examples of this in their writings.

Braid, for instance, tells of a naval officer who was the subject of many practical jokes. He entertained and acted upon any idea which was suggested to him when asleep without awaking. On one occasion, while lying in his berth, he was told that his ship was in action, and that his men were fighting all around him. His face immediately assumed an expression of martial excitement, and he wielded an imaginary sword. His friends supplied details of the fight, telling him that the battle was going against them, and that his dearest companions were being killed; then his expression changed to one of fear. Finally, when told that all his friends were slain, and that the rout was complete, he leaped from his place and fled with an aspect of terror. I have myself spoken to and received answers from nurses who had fallen asleep, worn out by long hours of watching; and examples of such automatic answering must be familiar to most people. On the other hand, patients in the hypnotic sleep sometimes pass into the natural state, when they are no longer in relation with the operator, but follow their own ideas in ordinary dreams.

As in natural somnambulism a person may be able to do things he is at other times incapable of; so in the artificially-produced condition he can sometimes be made to excel himself. Dr. Beaunis found in experimenting with the dynamometer that the muscular power could be greatly increased at times by suggesting in the hypnotic state increased strength and effort; and one frequently finds the grasp of an enfeebled patient can be perceptibly strengthened by similar suggestions. The therapeutic bearing of this experiment is easily seen.

Dr. Grazzini, of Florence, has kindly sent me some copies of drawings done while in a state of hypnotic somnambulism by an uneducated man who in waking moments hardly knew the use of a pencil. These copies are faithfully and well executed, but probably the man would have been quite unable to initiate a design. The faculty of imitation was strengthened by the hypnotic condition, and at the same time he concentrated all his attention on the figures, and took infinite pains to reproduce them.

An artist under the same circumstances would no doubt have produced a drawing in his usual style; and a musician, in a similar way, if asked to play, would perform some familiar air. Whatever a man's natural disposition might be it would come out if he were in a state of profound hypnotic sleep; but we shall see that "suggestion" in this condition has power to modify even life-long habits and deep-rooted tendencies. (Frequent repetition of the suggestion, especially if done with confidence, has what may be called a cumulative action, expressed by Professor Delbœuf in a kind of mathematical formula. This, of course, is also the case in our waking moments, and is well understood and turned to account by advertising tradesmen. The announcement in confident language on every blank wall that "Johnson's soap is the best," becomes, by constant repetition, almost an axiom, and we are inclined to accept its truth. In the same way it is told of George IV. that from constantly repeating the story of his being at Waterloo, he at length got to believe that he had really taken part in the battle.)

CHAPTER IV.

I HOPE to have shown in the preceding chapters that Dr. Liébault's system is the outcome of the collection and classification of many isolated facts previously neglected or misunderstood. That cures have been and still are worked by such means as are implied in faith-healing, the mind-cure, etc., and by charms and relics, is beyond doubt; but it is not in the supernatural that we should seek for the explanation of them. They all proceed from the same cause, and on the same lines. We have, firstly, the patient's strong desire for cure; and, secondly, his firm belief in the efficacy of the means used; while to these may generally be added the presence of a sympathetic and impressive environment. The reasonable and deliberative side of the patient's brain is suppressed, while the emotional or instinctive side is developed, and in proportion as the latter is predominant the greater generally is the success of the treatment. The Nancy school obtain, in suitable cases, as good results as it is possible to expect; but they work on scientific principles and by recognized laws.

A brief account of the treatment practised at Nancy, and of the theory which explains it, will, I think, make this clear.

If the visitor to Dr. Liébault's dispensary be one who measures results by the impressiveness of the means used, he will surely be disappointed to find how commonplace are operator, patients, and building. The rooms are unpretentious, and even shabby; the patients are ordinary-looking people enough, belonging mostly to the artisan and laboring classes; and the doctor himself, though he has goodness and kindliness written on every feature, is of unimposing presence; while his habit of chatting on all sorts of subjects with the persons around him, even while receiving patients, has an odd and hardly impressive effect.

The patient paying his first visit is directed to sit down and watch the treatment being applied to others. This gives

him confidence, and arouses that imitative faculty, which is so active in childhood and is never lost throughout adult life. When his turn comes, he is told to take his place in an arm-chair, and to make his mind as much a blank as possible—"to think of nothing at all"—and to fix his eyes and attention on some special object; almost anything will do, from the operator's face or hand to a mark on the ceiling or the pattern of the carpet. Then the phenomena which attend the on-coming of natural sleep are gradually "suggested" to him: "Your sight is growing dim and indistinct; your eyelids are becoming heavy; a numbness is creeping over your limbs; my voice seems muffled to you; you are getting more sleepy; you cannot keep your eyes open." Here the eyes close of themselves, or are closed by the operator, and it is generally found that the patient is indeed asleep.

About two minutes of this "talk about sleep" will usually produce the hypnotic effect on a new patient; and on subsequent visits even less time is required.

The patient being more or less influenced, Dr. Liébault now proceeds with the treatment proper. This consists essentially in directing the invalid's attention to the part affected, and suggesting an amelioration or disappearance of the morbid condition and symptoms. To take a very simple case—let us suppose that the malady is chronic nervous headache. The part of the head affected is gently rubbed, so that the patient's attention shall be attracted to it, and he is told that the pain is to disappear—that he will awake feeling his head cool, clear, and comfortable, and that there is to be no return of the trouble. In ordinary cases the whole process will not have lasted more than five minutes when Dr. Liébault brings it to a close by arousing the patient, which he does by telling him to open his eyes and awake. This is generally enough; he awakes as from ordinary sleep, and is told to vacate the arm-chair in favor of the next patient. When asked how he feels, he will generally reply that he is better, and very often that the pain has entirely vanished. He is quite his natural self, and can leave the room at once and go about his work as usual. Long acquaintance with the system prevents an inhabitant of Nancy from regarding it as anything remarkable, and a sick person consults Dr. Liébault just as he would consult any other physician, with the simple idea that the

treatment will do him good. He does not trouble himself with metaphysical theories, but is content to know that some acquaintance has been cured of a complaint similar to his own, and that he himself hopes to be relieved in a few days.

If the hypnotic sleep has been profound, it may be necessary twice or thrice to repeat the order to awake, and even to enforce it by fanning the patient, or blowing gently upon his eyes; but the simple command is nearly always sufficient.

There certainly is nothing mysterious in all this, and Dr. Liébault seems to take pleasure in making his whole mode of treatment clear to any serious inquirer, and in giving the rational explanation of everything that he does. He directs the patient to fix his attention on a certain point in order to strain the accommodation of the eyes and tire the sight. The effect of the strain is to cause dilatation of the pupils and consequent dimness of vision. The feeling of heaviness in the eyelids results from the fatigue of keeping them open in a strained position, and the assertion that the eyes are becoming tired and the sight dim is therefore founded on physiological data, and is not guesswork. The eyes being tired, the natural impulse is to close them, and this act calls up a previous association of ideas connected with fatigued or confused sight. That association points to sleep, toward which the patient is rapidly led, aided by the monotonous tones of the operator suggesting it to him, and by his mind being free from all disturbing thoughts, and his nerves from all external stimuli. He falls asleep, in fact, much in the same manner as one does when reading a dull book or listening to a not too brilliant discourse. Dr. Maury,[22] in his well-known work on sleep and dreams, says, "The less the mind is occupied with ideas the more easily can the thoughts be directed into any given channel. If nothing claims our notice or holds our attention, the cerebro-spinal system, for want of that gentle stimulation which is necessary to it, falls into a state of semi-torpor inseparable from atony of the nervous system."

In the chapter on sleep in Carpenter's "Physiology," various conditions are mentioned as being favorable to it, one being the desire for it, another the expectation of it. We expect, from previous experience, that if we lie down in a certain place, sleep will follow. The faculty of imitation helps to bring it about; when we see others g we naturally

incline to follow their example, and at night the consciousness that all around us are asleep disposes us to seek the same condition. Talking about sleep is apt to induce somnolence, just as talking about food may provoke hunger. And a monotonous sound, such as the droning voice of a speaker, or the breaking of gentle waves upon the seashore, tends to encourage slumber. Thus it will be seen how closely the artificial method I have described follows natural rules. This method may fail, just as we may fail to obtain natural sleep, or may battle it off should we desire to remain awake. If a patient wishes to resist the somnolent influence, he can do so by refusing to concentrate his thoughts, or by inducing some physical discomfort—for instance, by placing himself in an uncomfortable position. Strong emotion, such as anger or fear, will prevent the hypnotic sleep; so will severe pain, hunger, thirst, and indeed anything which preoccupies the mind or agitates the nervous system. Constitutional idiosyncrasies affect this as they affect the natural sleep. The naturally restless sleeper will be restless, and he who commonly goes off as soon as his head touches the pillow will quickly succumb to the hypnotic influence. The extent to which a person is influenced varies according to his mental and physical condition. If he is of restless and flighty temperament it may be impossible to fix his attention for even the few minutes that are necessary, and no effect is produced —except, perhaps, an inclination on his part to treat the whole affair as a jest, and a consequent irritation on the part of the doctor. But in ordinary cases some effect is certainly produced, if not on a first visit, still on subsequent ones. This effect will vary in various patients, some feeling only a heaviness and torpor, with a disinclination to open the eyes, while others fall into a more or less profound sleep, or into a state of somnambulism. Dr. Liébault divides the sleep into six different stages (Appendix, note 6), but as these really merge imperceptibly into each other, the division is purely arbitrary and is made for convenience in classification. They may be shortly summed up as: 1. Light sleep; 2. Profound sleep; 3. Somnambulism.

The first and second stages closely resemble and are analogous to ordinary sleep; but the third is *sui generis*, and will require a few words later on (Appendix, note 5). Though it

is analogous to natural sleep, there is one very important fact which shows that the conditions are not identical. If an ordinary sleeper is spoken to, he is generally aroused by the stimulating effect of the sound conveyed to the brain through the auditory nerves, but one in the hypnotic state may be talked to without being disturbed—the effect will, on the contrary, be soothing. He is, in fact, *en rapport* with the outer world, though only to a limited extent, whereas in natural sleep he is *en rapport* only with his own consciousness.

Upon this difference depends the possibility of applying curative suggestion. Carpenter (op. cit.) says that the very closure of the eyes renders the other senses more acute; and we have seen that the inactivity of one sense is nearly always compensated for by increased sensitiveness of the others. Now in the hypnotic state all the senses are more or less torpid and in abeyance until called into play by the operator. Physiologists suppose that during activity the nerve-centres are continually discharging nervous energy in all directions in response to stimulating impressions received through the senses; but in sleep a state of inactivity is induced, and the nervous force accumulates in the brain-cells. Natural sleep comes as a consequence of fatigue, and because the store of nerve-energy is nearly or entirely exhausted. During its continuance a fresh store of nerve-energy will be laid up, and if it be undisturbed, this store will go on increasing until sufficient is acquired for complete nerve recuperation. This point attained, the sleeper, if in good mental and bodily health, will awake naturally, and feel no further desire for slumber. But as the hypnotic state may be produced at any time in the twenty-four hours, and long before any perceptible inroad has been made on the store of nerve-energy laid up during the previous natural sleep, it follows that during the artificial sleep there may be great accumulation and excess of energy. All this can be concentrated and directed into any channel the physician may desire; and this concentrated and directed nerve-force must naturally affect the system more powerfully than any ordinary nervous impression. This fact may explain the rapid production of congestion to a given part (alluded to in Chapter V.), and also the sensation of warmth usually experienced in any part to which the attention has been drawn. It also accounts for the success of the treatment in paralysis of long standing.

We may imagine in such a case, and the surmise would probably be physiologically correct, that the nervous channels are blocked to ordinary impulses sent to them from the brain, but that the extraordinary impulse from an accumulation and concentration of nerve-force is sufficient to break down and overcome the obstruction; as a dam which easily withstands ordinary currents is swept away upon the bursting of a reservoir, by the rush of accumulated water.

Bernheim defines hypnotism as *the production of a psychical condition in which the faculty of receiving impressions by suggestion is greatly increased.* But this is only half the truth; for not only is the receptivity increased, but the power to act upon and carry out the suggestion is increased likewise. Suggestions have all the force of commands, and the patient will strain every nerve to obey them. If he is told to move a paralyzed limb, or to speak after months of loss of voice, one can see what intense effort he puts into the attempt to comply. A stammerer making such effort will speak fluently, and a deaf person will distinctly hear a whisper. To express adequately the cause of such effects, the word "suggestion," in English at least, is far too weak, and therefore somewhat misleading.

The increased force of suggestion does not depend so much as one might suppose on the profoundness of the sleep. In the case of deafness, referred to above, the hypnotic effect was extremely slight; and, on the other hand, I have heard a person in a state of decided somnambulism argue with the operator as to the correctness of his assertions. In applying suggestion, all that is necessary is a state of increased receptivity of ideas suggested by the operator, and an ignoring of other impressions. This attained, it matters little from a therapeutic point of view whether light sleep, profound sleep, or somnambulism, is produced. My own experience, like that of all observers whom I have known, is that good results are effected when there has been no loss of consciousness, and even when the patient denies having felt any hypnotic influence. (A gentleman, whom I am treating for various nervous affections, always denies having slept, and protests that he has remained conscious of everything going on around him. Yet if I put some small article, such as a paper-knife, into his hand during the sleep, and tell him to hold it tightly, he will do so, and

on being aroused will show surprise at finding himself grasping it.)

Consciousness is lost only in the advanced stages of profound sleep, and even when this has occurred there is remembrance on waking of everything that has happened during the sleep. A patient in profound sleep may be questioned, and will probably return answers, unless the question be put too brusquely, when it will be likely to wake him, or too gently, when he may shirk replying; for a person in this state dislikes being disturbed, and is especially unwilling to exert his reflective faculties. Nevertheless, if questioned as to his complaint, he will give truthful replies, and thus may help the physician in his diagnosis and treatment.

Bernheim seems to accept the theory of Herbert Spencer,[23] and of most pyschologists, that two sorts of nervous action go on within the brain—the one automatic and instinctive; the other rational, volitional, and deliberative. Hypnotism suppresses the latter (the *Ego* of some psychologists), and allows full play to the former (see Appendix). It follows that where the second kind of nervous action prevails in an individual, he is less liable to be acted upon by external impressions, and is less the creature of impulse than one in whom the first kind is predominant. The more a man's actions are the result of impulse rather than of reason, the more susceptible he is to external impressions, and therefore to suggestive treatment. (He who obeys his instincts, and instantly knocks down a man who has insulted him [this being a purely automatic action], would thus be a better subject for hypnotism than he who deliberately calls a policeman and goes in for damages.)

This brings us to the question, Who are the best subjects for the treatment, and how far is it applicable to the bulk of mankind?

Professor Charcot asserts that it is suitable, and indeed possible, only for hysterical subjects. He divides the hypnotic sleep into three well-defined stages: 1. Lethargy; 2. Catalepsy; 3. Somnambulism; and contends that there is a regular sequence in these, and that, according to the will of the operator, one or other can be produced. (He obtains a state of lethargy by fixing the patient's eyes on a given point, or by gentle pressure on the eyeballs. This state resembles natural

profound sleep. It passes into the second stage when the eyelids are opened: cataleptic rigidity may now be produced in a limb, and it may be bent or placed in any position. Moreover, emotions corresponding with the position are evoked. If the subject is put into a pugilistic attitude, his expression will become fierce and determined; if into one of prayer, it will wear the aspect of devotion. The third stage is produced from the first or second by gently rubbing the top of the head, when the cataleptic condition will vanish, and other characteristics will appear, chief among which are abnormal acuteness of the senses, and obedience to suggestion. The reader must be struck by the artificial nature of these stages.)

Drs. Liébault, Bernheim, Beaunis, and others of the Nancy school deny the existence of these three stages. They assert that their experience in treating hypnotically a vast number of patients leads them to the conclusion that nothing resembling them has been or can be evoked *spontaneously.* They consider, in fact, that Professor Charcot has introduced a new hysterical condition into the Salpêtrière, and that this has become as it were an institution of the place which every new-comer hastens to comply with. They support this assertion by showing that when they in their Nancy practice explained to hysterical patients the effects produced by Charcot, the three stages, never before manifested, were forthcoming. Bernheim has well said: "Méfiez-vous de la suggestion;" and an English physician has given an equally sage warning: "Take care, or you will find what you are looking for." (Braid was at one time misled into supposing that by touching the phrenological "bumps" he produced corresponding effects. For instance, if he touched the "bump" of Destructiveness, the subject immediately proceeded to hit out and to destroy whatever was within his reach; if that of Benevolence, he would give away his watch, purse, etc., to any bystander. The fact is, that the sense of sight [under the apparently closed eyelids], that of hearing, etc., are so abnormally acute in somnambulists, that the slightest hint of expression, voice, or touch, is sufficient to evoke from them the desired response.) Charcot has thus entered the field weighted with a theory which he seems unable to shake off. If one of his school is shown a broad-shouldered navvy or a sun-dried old soldier in a state of

profound hypnotic sleep, and is asked whether this looks like an hysterical subject, he will reply that appearances are deceptive, and that the very process of hypnotizing has developed a latent condition of hysteria, or one analogous to it. To my mind the great merit of Dr. Liébault is, that he approaches the subject with only one end in view—the relief of disease. If the theories he has deduced from observed facts (for every man who is not a mere empiric must hold theories) do not, after closer observation, continue to correspond with them, the theories are thrown over, and not the facts, as too often happens. The Nancy school may therefore be called practical and therapeutic, in distinction from Charcot's, which is theoretical and experimental.

The following table, taken from Professor Beaunis's work, proves what a mistake it is to suppose that only hysterical persons are influenced by the treatment.

Patients submitted to hypnotization by Dr. Liébault in 1880 (1,014):

Not influenced,	27
Drowsiness,	33
Light sleep,	100
Heavy sleep,	460
Very heavy sleep,	232
Somnambulism (slight),	31
" (advanced),	131
	—1,014

Professor Beaunis snows as follows the percentage of the different stages of hypnotism at different ages:

	Somnambulism.	Very Heavy Sleep.	Heavy Sleep.	Light Sleep.	Drowsiness.	Uninfluenced.
To 7 years	26.5	4.3	13.	52.1	4.3	....
7 to 14 "	55.3	7.6	23.	13.8	....	....
14 " 21 "	25.2	5.7	44.8	5.7	8.	10.3
21 " 28 "	13.2	5.1	36.	18.3	17.3	9.1
28 " 35 "	22.6	5.9	34.5	17.8	13.	5.9
35 " 42 "	10.5	11.7	35.2	28.2	5.8	8.2
42 " 49 "	21.6	4.7	29.2	22.6	9.4	12.2
49 " 56 "	7.3	14.7	35.2	27.9	10.2	4.4
56 " 63 "	7.3	8.6	37.6	18.8	13.	14.4
63 and above	11.3	8.4	38.9	20.3	6.7	13.5

These statistics refer, of course, to Nancy, and, as has been already pointed out, that town is pervaded by an atmosphere

of hypnotism and suggestion. But my friend Dr. Van Eeden assures me, that at Amsterdam he finds the proportion of the "uninfluenced" but little larger. The proportion of somnambulists, however, is undoubtedly much greater at Nancy than we could expect to find it in England. Among about fifty patients I have as yet found only two or three.

And here a word on the subject of somnambulism. As natural somnambulism is nearly always associated with mental or bodily weakness, so the artificial variety is, I believe, found chiefly in patients whose minds are weakened by hysteria or an allied nervous condition, or whose bodies are enfeebled by phthisis or some other wasting disease. It is an abnormal product of hypnotism, and, interesting though the phenomena may be from a pathological and psychological point of view, they are no more a part of suggestive treatment than an exhibition of the poisonous effects of drugs is a part of ordinary medical practice. They help to elucidate points in the treatment, and therefore must be studied, but experimentation upon them is outside the scope of the physician, as such. (See Appendix. Hypnotism being a new thing in England, the knowledge of it seems chiefly confined to theory, and one has to hear many fanciful and exaggerated statements. For instance, in an article on the subject in the "Saturday Review" of December 8th, 1888, *à propos* of a paper of mine in the "Nineteenth Century" for December, the writer, evidently a medical man, states that a person once hypnotized is at the mercy of the operator, who can repeat the operation at will, even without the consent of the patient. Further, that any one can easily hypnotize a person who has once submitted to hypnotism; and again, that a person once hypnotized is unable to look people in the face without feeling an irresistible desire to sleep. I have made inquiries among my patients of both sexes, some of whom have been hypnotized many times, and have fallen into the profounder degrees of sleep. They can all certainly look me in the face for any length of time without feeling in the least degree sleepy; and they all tell me that until they entirely give up their minds to the operation no soporific effect is produced. Most misleading conclusions have been drawn from exceptional cases, such as that of the "Soho sleeper." These belong in no sense to hypnotism as a therapeutic system, but are examples of hysteria. Constantly

hypnotizing a weak-minded person for experimental purposes will probably bring about a morbid state of brain, and such abuse of a therapeutic agent can only be deprecated and discouraged.)

CHAPTER V.

We are now in a position to speak of suggestion as a mode of treatment and cure, and we will first consider to what class of diseases it has hitherto proved applicable. And here I may say that, although Dr. Liébault rarely gives medicines, but obtains most of his remarkable results by the suggestive treatment pure and simple, his followers by no means dispense with those remedies which the researches of generations of able men have put within their reach. In suitable cases they make use of dietetics, drugs, electricity and massage, and the combination of these means with suggestion often gives better results than any simple treatment.

The suggestive method is especially applicable to chronic complaints. Rheumatism and gout often yield to it, as do also many diseases of mal-nutrition, such as anæmia and "general debility." In derangement of the functions in women it acts very beneficially, both in checking excessive loss and in promoting a proper flow; also in relieving or curing periodic sufferings of all kinds. In chronic constipation and diarrhœa it has excellent effects, and patients usually find that the intestinal functions become regular through its use. Indeed, therapeutic suggestion gives a healthy tone to the organic system generally, and tends to regulate all its functions. A consideration of the experiments of Bernheim, Delbœuf, and others will render this statement more comprehensible than it may appear on the surface.

Suggestion is extremely useful in cramp from the over-use of certain muscles, such as is commonly found among writers and telegraph clerks. It is very successful also in cases of old-standing paralysis, and especially so in the infantile variety. Many practitioners speak highly of its curative power in skin disease, and in affections of the eyes, and it is found beneficial in some forms of deafness. In fact, wherever we find chronic

disease resisting the usual methods of treatment, suggestion may be thought of as a useful ally.

Its power over the organic processes has been clearly shown by many experiments, made either on students of the system or on patients, with their own previous consent. A patient in the hypnotic sleep is told that he has burnt his hand or some other part of his body; he not only feels heat and pain in the place indicated, but it frequently happens that the spot becomes red and inflamed, and exhibits all the objective signs of congestion, and even of inflammation, vesication, etc. The suggestion of the operator has, through the patient's imagination, been able to affect the vaso-motor functions of the sympathetic nervous system. This experiment and others of a like nature open up a wide field of pathological interest; for if suggestion can cause an increased flow of blood to a part, and local congestion and inflammation, can it not also dissipate and cure these conditions when they occur in disease? Clinical experience answers in the affirmative.

Professor Delbœuf, of Liége, desiring to ascertain the positive effect of hypnotic suggestion in the treatment of a burn, and being of course unable to find two persons of identical constitution and condition generally, used the ingenious device of producing, with caustic, two exactly similar burns on the same person—one on each arm—and of treating one wound by curative suggestion, combined with the usual remedies, and the other with the usual remedies only. Having induced hypnotic sleep, he suggested to the patient that the one arm should be cured painlessly and without any suppuration; and it did in fact heal, by simple separation of the slough and healthy granulation, ten days earlier than the other, which went through the suppurative process, accompanied by inflammation and pain (op. cit., p. 9). Were this case not reported by a well-known *savant*, I confess I should feel some hesitation in recording it here; as it is, its accuracy is beyond doubt.

Professor Beaunis (op. cit.) notes a case in which, by suggestion, he regulated the pulse of a patient. Before sleep there were 96 pulsations in a minute, which during the sleep increased to 98.4. He suggested a reduction, and it fell to 92.4. The pulse having again risen to 100.2 he suggested an acceleration, and it further rose to 115.5. The slackening and

quickening of the pulse in each instance followed immediately upon the suggestion. The tracings were taken by Marcy's sphygmograph; and of these fac-simile reproductions are given in Beaunis's work. He also succeeded in slightly raising the temperature of patients by suggesting an increase of warmth.

He describes at some length the production of all the effects of a blister by suggesting that one had been applied. "M. Focachon, a chemist of Charmes, showed us (Drs. Bernheim, Beaunis, and Liébault) this phenomenon on a patient whom he brought to Nancy. During her sleep, at about 11 A.M., eight postage stamps were applied to her left shoulder, while it was suggested to her that they were a blister. She was allowed to sleep all day, being, however, aroused for meals, and was kept under observation. . When she retired for the night she was told to sleep until seven the next morning. At 8:15 A.M. the dressing which had been put on was removed, and the stamps were found *in situ*. The surrounding skin, for four or five centimetres, was thickened, modified, and of a yellowish-white color. The cuticle, however, was not raised, and did not form a blister; but it was thickened and wrinkled, and presented the appearance usual before complete vesication. This part of the skin was surrounded by a zone of intense redness and swelling. M. Focachon and the patient returned to Charmes, and by 4 P.M., four or five vesicles were developed. Fifteen days later the blister was still suppurating freely. M. Focachon made a similar experiment on another patient, and in forty-eight hours produced a blister, which followed the same course."

Professors Bourru and Burot, of Rochefort, succeeded in causing hemorrhage from the nose, by suggesting that it should take place, in a young soldier of epileptic and hysterical constitution; they even fixed the hour when it should come on. On this same subject Dr. Mabille, of the lunatic asylum at Lafond, produced instantaneously, by suggestion, hemorrhage from different parts of the body, exactly similar in character to the stigmata of some mediæval saints.

It will thus be seen that suggestion is an exceedingly powerful agent—effective in the hands of the experimentalist, and efficacious also in those of the physician. When we consider that the knowledge of this treatment has only become general within the last four or five years, we must acknowledge that

its progress, and the number of diseases which it affects, are both remarkable. But we must also acknowledge that it is no universal remedy, warranted to act like magic on all diseases. In some cases it is powerless, or comparatively so. It cannot restore a joint altered by chronic rheumatism or gout, nor put right an internal displacement, not can it remove cancer or other malignant disease; neither will it cure paralysis agitans, glaucoma, advanced Bright's disease, or diabetes. Neither can it materially benefit cases of phthisis or organic heart disease, though it may do much to relieve the sufferings incidental to all painful affections. It has been but little employed in acute illness. I believe that most of the Continental practitioners of the system use it chiefly at consultations in their own rooms, where, of course, sufferers from acute diseases are not likely to present themselves. It has occasionally been used in childbirth, with beneficial results; but in surgery it is not often employed. No doubt a few susceptible persons might be painlessly operated upon while under its influence; but, as a rule, the natural agitation of a patient before an operation would so distract his attention as to render hypnotism impossible; whereas chloroform and other anæsthetics are easily administered, and are commonly certain in their effect. Professor Bernheim, however, uses suggestion in conjunction with chloroform, and finds that his patients take the anæsthetic better, and require a much smaller quantity, than when it is administered silently in the usual way. This is the experience of many chloroformists.

Suggestion may be usefully employed instead of narcotics in temporarily relieving acute pain, by inducing sleep which will not be followed by the deleterious consequences of such drugs. It is also used in cases where the sleep itself is remedial, as in threatening congestion of the brain, delirium tremens, and in insomnia, when it exists as an independent condition and not as a symptom of disease.

But it is in the so-called "neuroses" that suggestion obtains its most brilliant successes—in functional epilepsy, St. Vitus's dance, asthma, palpitation, nervous headache, spinal irritation, neurasthenia, ovarian pain, and the many forms of dyspepsia. Nervous disease is, unfortunately, ever on the increase; and the study of its symptoms, its cure and prevention, must increase to keep pace with it. As civilization ad-

vances, humanity develops "nerves," which, in this sense, may be said to have no existence in the savage and barbarous states. The vices and virtues of civilization tend alike to increase our sensitiveness. Drink, narcotics, the abuse of tobacco, social excitements, intellectual culture, the ever-spreading desire to be or do something remarkable—these and many other stimulating influences are perpetually at work to promote nerve-disease among us. In large cities especially, where men live under artificial conditions and at high pressure, we find in all classes of the community affections presenting subjective symptoms quite out of proportion to the objective signs. It would be interesting to ascertain what proportion neurotic affections bear to organic diseases in a city doctor's day's work. Probably one-half at least. Many of us when fresh from the hospital are vexed and surprised to find how much of our practice is made up of such cases. They are really among the most painful and difficult complaints a physician is called upon to treat, for they generally indicate a weak and depressed state of vitality, in which the slightest suffering is felt with intensified force. Take the medical nomenclature ending in *algia:* cardialgia, cephalalgia, gastralgia, myalgia, neuralgia—what visions of suffering do these words call up!

Though these affections often depend upon organic disease, they more frequently have their source in nerve irritability and functional weakness. How they perplex the able practitioner, who feels quite at home with a case of scarlet-fever or inflammation of the lungs! Nervous disease generally—hysteria and hypochondria in their many forms—are spoken of contemptuously by some pathologists, who are impatient of subjective symptoms which have no apparent objective reason for existence. Therefore we must not be too severe on the friends of hysterical and nervous patients, who, perhaps after long endurance of their complaints, grow intolerant, and, it may be, incredulous of their sufferings. It is natural to ascribe to imagination an ailment for which neither friend nor physician can find any comprehensible cause; yet these so-called fanciful ailments may be as real as typhus, and entail a thousand times more suffering on the patient. Bodily weakness, unaccountable pains, depression of spirits, a weight of misery accompanied by the conviction that no power on earth

can lift it, a sense of being neglected by friends, or of being to them a weariness and trouble—all these sufferings of mind and body are real enough and hard to bear, whatever their original cause may have been.

There is no doubt that they are sometimes brought about by the patient's own fault. They may spring in the first instance from indulgence in bad habits, from idleness, from a tendency to foster and dwell upon morbid ideas; in short, they frequently are diseases *caused by the imagination*, which is quite a distinct thing from *imaginary diseases*. Indeed, there *is* no imaginary disease; he who persistently imagines a disease in himself *has* one, though possibly not the one he imagines. For the imagination which can furnish its owner with a bodily disease is itself not in a state of health. Who with healthy, well-balanced mental powers could or would bring upon himself a sickness by auto-suggestion? "No one can be a hypochondriac at pleasure," aptly says Lavègne.

"When one of those hypochondriacs," write Binet and Féré, "whom we are apt to call *malades imaginaires*, comes to seek the help of medicine, complaining of subjective pains and uneasiness, what do we often reply? 'It is nothing; it is merely fancy; try not to think about it;' and he is sent away with some anodyne or simple remedy. This invalid, who has suggested to himself his disease, and who really suffers from it, becomes convinced that it is not understood, and that nothing can be done for him. The more he trusts his physician, the deeper is this conviction, and he who came with merely a chronic complaint may go away with one which is practically incurable."

The disease induced by morbid auto-suggestion may be controlled and cured by healthy suggestion from without, given when the brain is in a state peculiarly receptive of outer influence. The mind of a nervous, hysterical, hypochondriacal person is usually shut against all outward influence, except such as corresponds with and feeds its morbid state. The patient when awake rejects cheerful and hopeful suggestions almost as if they were insults, but in the hypnotic sleep, his morbid self-influence being temporarily in abeyance, his mind will admit and act upon suggestions of bodily and consequent mental cure.

The suggestive system has been extensively taken up by

foreign lunacy and mental physicians. Among these are Drs. Sémal, of the Asylum at Mons; Mabille, chief physician of the Asylum at Lafond; Burckhardt, of the Asylum at Préfargier (Switzerland); these specialists and others frequently report cases of amelioration and cure through the use of suggestion in the "Revue de l'Hypnotisme."

The insane are not easily influenced by hypnotism; all who have anything to do with them know how difficult it is to get them to fix their attention on anything except their delusion, but once an influence is gained over them, suggestion may prove most useful.

That border-land of insanity occupied by dipsomania, the opium habit, and the excessive abuse of tobacco and other narcotics, offers to the suggestive treatment an extensive field of usefulness. Professor Forel, of Zurich, in his address at the Congress of Neurologists, held at Zurich in 1888, gave it as his opinion that suggestion is a very beneficial, and often a very powerful, agent in these cases, frequently enabling the drunkard to take that first step, which is always so difficult, toward reformation and cure. He cited also several cases in which he had succeeded by its means in curing patients of the opium habit in from eight to twelve days, and that without the acute mental suffering which is commonly felt when an enslaving habit is quickly broken off. Drs. Van Renterghem and Van Eeden (of Amsterdam) likewise tell me that they have had great success in overcoming these moral diseases. At Nancy I had the opportunity of seeing many such cases in process of cure. One man came to Dr. Liébault completely shattered by indulgence in tobacco, which he both smoked and chewed. He was a railway porter, a big, strongly-built fellow, but he was weak, and shaky through his excesses. His digestion was faulty, his tongue thickly furred, and he had no appetite. His pulse was slow and intermittent; he felt giddiness on movement, and his sight frequently vanished through incipient amaurosis. Persons whose nervous systems are broken down in this way are very easily hypnotized, and Dr. Liébault soon had this man in a state of profound sleep. He then told him that he was to give up smoking, that a pipe was to be to him an object of loathing, and a quid of tobacco even more offensive. Also, that if he did indulge in one or the other, pain and sickness would be the result, and that he must

not even feel a desire for the indulgence. The patient came daily for several mornings, and daily showed an increasing improvement, till in a week he was completely cured of the symptoms of nicotine poisoning. He would, of course, have been cured by voluntary abstention from tobacco, but I doubt if the beneficial effect would have been so rapid—and no one seeing the man would have credited him with the moral courage and determination necessary for breaking off a long-cherished habit. It is told of the younger Dumas that he was formerly an inveterate smoker, and on one occasion, feeling out of health, went to consult his doctor with the usual cigar in his mouth. The physician, one in whom Dumas had entire confidence, having heard his symptoms, told him plainly that smoking was destruction for him, whereupon the great writer immediately flung away his cigar, declaring that he would never smoke another—and he has kept his word. But how many are gifted with such resolution?

In the "Revue de l'Hypnotisme," 1886–1887, some papers appear by Dr. Voisin, of the Salpêtrière, showing the efficacy of suggestion in the treatment of moral obliquity; and at the Congress of the French Association for the Advancement of Science, held at Nancy in 1886, papers dealing with this subject were read by several physicians of eminence. Dr. Voisin gives instances of female prisoners, formerly considered incorrigible, who, after a course of suggestive treatment (combined with the religious and moral instruction which, alone, had unfortunately proved ineffectual), became modest, cleanly, and industrious. Some of these reformed women have been placed in situations of trust, which they hold satisfactorily.

In these cases a state of double consciousness (writers on somnambulism give many instances of this double consciousness), such as one sometimes sees in natural somnambulism, was probably induced. A subject of this kind may live two alternate lives, one good, the other evil; and in one of these lives she will be unconscious of her actions in the other (Forbes Winslow, op. cit., p. 420). In some instances both of these utterly different lines of conduct will appear so rational that it is difficult to decide which is natural to the subject. (The story of "Dr. Jekyll and Mr. Hyde" might be founded on one of these cases.)

In course of time the new personality, induced by sugges-

tion and encouraged by religious ministration and teaching, will displace the old, and a complete moral revolution will be the result. At the Nancy Congress, Dr. Liébault and others gave instances of dull, idle, and troublesome children being by suggestion (combined with judicious home-influence) made models of industry and good behavior. A boy who at school had habitually been at the bottom of his form, was by this treatment so incited to work that he soon occupied a place at the other end. Another child, seven years of age, so obtuse as to be almost an idiot, was so benefited by suggestion, that in three months he could read, write, and do the first four rules of arithmetic. (See also page 778. In cases of *complete* idiocy, suggestion may be considered powerless, the difficulty of exciting the attention being practically insuperable.)

Many people may object to the use of this treatment in moral cases, on the ground that it is a tampering with the free-will of those influenced. To this I would reply that all education and all exercise of moral influence are an interference with this free-will. Most children prefer play to work; some will tell a lie to escape punishment; all are addicted to a variety of faults and bad habits; and educational and reformative means of various kinds must be used to train them to industry, truthfulness, and general excellence of conduct. Where these ordinary means are efficacious, no others need be, or ought to be, employed, and it is only when they have failed after repeated trial that suggestion should be resorted to. As in bodily illness, the system should be applied only in obstinate cases and when other methods have proved ineffectual, so in the far more serious cases of moral infirmity should it be used as almost a last resource, and with the greatest caution.

One is frequently asked whether the cures worked by suggestion are of a permanent character. To this I reply, they are as permanent as cures effected by any other means. Relapses occur in many diseases, no matter what treatment has been employed; sometimes through some carelessness on the part of the patient or of those who have charge of him. A person who is cured of rheumatism to-day, may to-morrow get fresh cold and develop a new attack, or other symptoms. But with proper attention, and the customary precautions as regards diet, rest, temperature, etc., the success of this treat-

ment is not transitory. The improvement effected by its means is often so marked and so rapid that patients are tempted to discontinue its use, and return to their ordinary habits before the cure is perfected and the habit of disease broken, forgetting that when a diseased condition has existed for some time it probably has taken firm hold on the system, and is not to be dispelled in a day. Sudden cures are apt to be fallacious, as are such cures by other modes of treatment; and though brilliant results are sometimes attained they can never be counted upon, and there should be no disappointment when improvement is a little delayed.

On the very threshold a difficulty may occur; the patient will perhaps appear insusceptible. This need not cause discouragement, for in many cases the hypnotic influence is not felt after three or more séances. But very few persons remain insusceptible to it; and when once it is established, the hypnotic state is afterward more easily induced, and tends also to become more intense, though this does not necessarily follow. (See tables, page 751. An apparent trifle may cause one operator to fail where another will succeed at once. I know a very able foreign physician who completely failed to influence two English patients, becuse he smelt of garlic, and so called up disturbing emotions in their minds. I was once unsuccessful with a gentleman, who afterward told me the reason of my failure. He imagined, as many do, that it is essential for the operator to possess great strength both of mind and body. When I touched his eyes to close them, he observed a slight tremor in my hand, and attributed this to a physical or mental weakness, which, he argued, must prevent my influencing him—a stranger, and a strong man of high intellectual capacity. The idea called up a resistance, which rendered him insusceptible. Subsequently, when I had explained to him that my personal attributes were, in this matter, of no consequence whatever, he easily fell into a profound hypnotic sleep.)

It is very difficult to eradicate a deeply-rooted popular belief, and it is not very easy for a practitioner of the suggestive system to avoid being called a magnetizer, since artificially induced sleep is the common preliminary of the treatment. But, as I have already stated, Dr. Liébault and his disciples absolutely reject the fanciful theories regarding ani-

mal magnetism which were held fifty years ago. They contend that no unusual gifts are needed to practise the system, and that the chief requisite is confidence. (The above example shows how want of confidence may be detected by the patient, and how the very suspicion of it will cause failure.) With wider experience comes increased confidence in one's self and in the system, followed naturally by increased success.

But "majus remedium majus venenum" is a true saying, and it would be an exception to all rule if such a powerful remedy as suggestion were not liable to abuse. When dynamite was discovered, no one denied that the lawless and desperate would, if possible, turn it to bad account, yet it was not tabooed for this reason, but its manufacture and distribution have been surrounded by precautions and restrictions, and it is allowed to occupy its proper place in applied science in the hands of miners and engineers. Sir James Simpson was not prevented from making public his grand discovery of chloroform became nervous people were afraid it might be employed for evil purposes; nor is its use forbidden, though every year a certain percentage of crimes and outrages are committed by its aid. Poisoning by arsenic, corrosive sublimate, and digitalis sometimes occurs, and yet these drugs occupy a prominent place in the pharmacopœia. For it is found that although these powerful agents are sometimes used to inflict harm, the evil caused by their illegitimate employment is so outweighed by their usefulness that no one would think of suppressing them. So with hypnotism. Its power for good is undoubted; it fills a place that nothing else can fill so adequately, and used with proper precaution and under necessary restrictions it is perfectly safe.

Dr. Sémal, in the discussion on hypnotism in the Belgian Academy of Medicine (June 30th, 1888), having condemned the prostitution of the system by travelling *prestidigitateurs* and charlatans, spoke strongly in favor of having it included in the medical curriculum of the universities, as being the only legitimate means of making it known. "This course," he said, "would prevent its being used empirically and stupidly, and would keep it as a powerful therapeutic agent in the hands of the medical profession as long as the art of healing is practised."

The exploitation of hypnotism as an exhibition at public

entertainments has already been prohibited by law in Switzerland, Holland, and other countries, and when the true position of the system is understood among us probably the same restrictions will be enforced in England. Such experiments are always useless and often cruel, besides being an offence against the dignity of humanity. The contortions and exclamations of a patient under chloroform are often interesting, and might by some persons be thought amusing, but we should hardly choose to excite them for the gratification of idle curiosity or the entertainment of the multitude.

The practitioner who uses hypnotism should do so with the same precautions which he adopts in administering an anæsthetic. Chief among these are obtaining the formal consent of the patient, and, when expedient, of his friends, and never operating save in the presence of at least one witness. Thus he will guard himself and his patient from all possible imputation of wrong-doing or abuse of power. I need hardly add that a patient desiring hypnotic treatment will, if commonly prudent, use discrimination in choosing a physician, and will avoid placing himself under the influence of one not known to him, at least by reputation.

The dangers of hypnotism are, I believe, exaggerated. The stories told of persons obtaining undue influence over others by its means are mostly fables, which experience shows to be impossible. Professor Bernheim asserts, and is borne out by other observers, that no one can be hypnotized against his wish, and that in fact it is his own will which sends him to sleep. Nevertheless, there is no doubt that after a time the on-coming of sleep is less under the patient's control, and when, as we see sometimes at Nancy, a person is continually being hypnotized by the same operator, the hypnotic state can be reproduced with surprising readiness. I believe that in certain hysterical cases there arises a craving for this, as there might for any other sedative; but such a craving has little chance of being encouraged if the suggestive practice is confined to its proper sphere. A physician does not go on prescribing narcotic drugs because a patient has a craving for them, but on the contrary, forbids their use when they cease to be beneficial.

The physician practising suggestion may protect his over-sensitive patients from the dangers of being hypnotized by a

stranger. He has only to impress upon them, while they are in the hypnotic state, that no one can produce any such effect upon them without their free will and formal consent. The most practised operator would try his art in vain upon one so protected, as Drs. Liébault and Bernheim have repeatedly proved (these physicians were in the habit of hypnotizing an hysterical patient, who used to fall into somnambulism as easily in the hands of one as in those of the other. On one occasion, while she was in this state, Dr. Bernheim told her that she was not to be influenced by Dr. Liébault. She awoke quite oblivious of this suggestion having been made, and soon afterward went to Dr. Liébault, who was ignorant of what had taken place, and asked him to hypnotize her as usual. To the surprise of both patient and doctor, all his attempts to do so were futile, and it was only on communicating the fact to Dr. Bernheim that his colleague found its explanation), and as I myself have seen.

I may fitly bring this chapter to a close with a quotation from Professor Bernheim's oft-referred-to work: "It is the duty of the physician to select what is useful in suggestion, and to apply it for the benefit of his patients. When, in the presence of sickness, I think that therapeutic suggestion has a chance of success, I should consider myself to blame as a physician if I did not propose it to my patient, and if I did not even make a point of getting his consent to its employment" (op. cit., p. 580).

CHAPTER VI.

In this chapter I propose to give an extract of cases successfully treated by hypnotic suggestion, from the writings of Professor Bernheim and others. Most of the reports are much abridged from the originals.

Case I. *Aggravated Hysteria for a Year completely cured by Suggestion in Three Séances.*[25]—Madame X——, aged 26; mother of two children. A lady of good constitution and lively temperament. She had not suffered from any symptom of hysteria until 1885, when an attack was brought on by some domestic trouble. From that time any annoyance induced a nervous crisis; otherwise she continued in good health.

Dr. Bernheim was consulted in October, 1886. The attacks had then increased in frequency and severity. They occurred about once a week, and were ushered in by a feeling of general weight and heaviness, and by a sense of constriction at the throat. These premonitory symptoms were followed by a deep sleep, which lasted from ten minutes to an hour. After this came general muscular tremors, which increased to strong convulsive movements, alternating with general rigidity, arching of the spine, etc. On this stage followed one of muttering and hallucinations, loud laughter, and gesticulation. After the attack had lasted from one to two hours it passed off, leaving great exhaustion and malaise, with complete forgetfulness of what had occurred during the fit. On October 19th Dr. Bernheim was consulted; he examined her and found nothing organically wrong. He hypnotized her, and she at once fell into a profound sleep. He suggested while she was in this state that there should be a disappearance of the malady, and that it should not reappear. On October 21st and 23d she returned, and was again subjected to the treat-

ment. There was no further need for suggestion, as the patient was cured and remained free from hysteria.

CASE II. *Hysterical Aphonia for Two Months, rapidly Cured by Suggestion.*[26]—Madame C. L——, aged 30, has been hysterical since girlhood. On January 15th, 1884, having been voiceless for two months, she consulted Dr. Bernheim, who first applied electricity to the throat externally, affirming the while that it would cure her. As that, however, had no effect, he hypnotized her, and at once induced a profound sleep. He suggested to her while she slept that her voice should return, but on awakening her he found no improvement. The second and third séances were equally unsuccessful. At the fourth she slept more heavily, and Dr. Bernheim was able to make her say she expected to be cured in eight days (the following Tuesday). (In many cases it is most important to get the patient to fix a time for her cure; the idea becomes deeply implanted, and, in hysterical cases, it is generally realized. Of course, the sleep must be very profound to make this possible.) He continued to hypnotize her daily, and each day he caused her to repeat that she was to be cured on the Tuesday. When that day came she was quite unconscious of having made this prophecy, she was still voiceless, and was hypnotized as usual. Dr. Bernheim told her she must speak when he awoke her, and impressed her strongly with this idea. On arousing her she said in a feeble voice, "I think I can speak now." The voice became gradually stronger, and by the evening was restored to its normal quality and volume. Dr. Bernheim gives many other cures of hysterical aphonia, several of them after one séance.

CASE III. *Choreic Movements of the Hands and Inability to Write, Cured by Hypnotic Suggestion.*—Victorine A——, aged 12½, of lymphatic temperament and good constitution, affected with chorea of the right side. It appears that when she was four and a half years old she suffered from general chorea, brought on by fright. It was a very severe attack, as she could neither walk nor talk, and had great difficulty in eating. It lasted three months. A second attack of the same kind came on when she was seven and a half. She was attacked a third and fourth time at intervals of two years.

In the fifth attack she was brought to Dr. Liébault for treatment. It commenced on May 27th, and on that day she had seven very violent fits, on the 28th and 29th the same number, and then she was hypnotized for the first time. After-

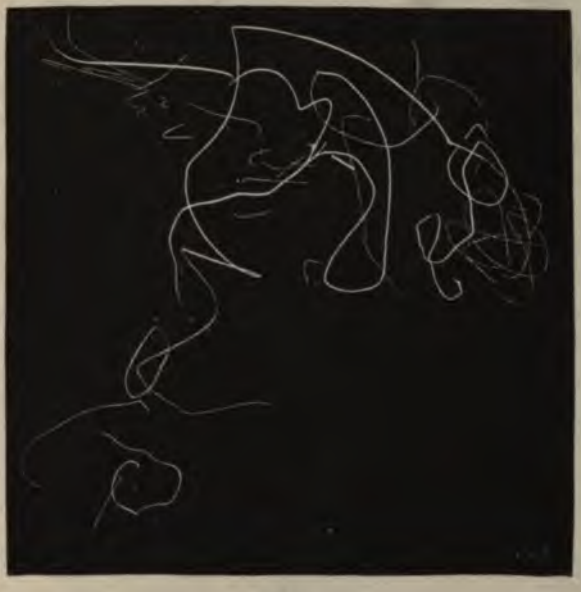

PLATE 1.

ward, in the afternoon, she had two fits slighter than the preceding ones. On May 31st again hypnotized. On that day she had one fit, and then no more until June 9th, when she re-

PLATE 2.

turned to be treated for a relapse brought on by fright. Professor Beaunis happened to be at the dispensary, and he got the patient to attempt to sign her name. In spite of much effort, the child—a very intelligent and docile little girl—com-

pletely failed to make any distinguishable letter on the paper. Dr. Liébault hypnotized her, and while asleep she was directed to write her name (Pl. 1). The result was fairly legible, and she wrote without hesitation or trembling. She was soon awakened, and again told to write. Without difficulty she at once wrote her name and address in very creditable style (Pl. 2). For the next few days she continued under observation and treatment, and was then discharged perfectly cured.

Professor Beaunis says he makes no remarks on this case, as the handwriting appeals more than words can to an unprejudiced mind.[27]

Case IV. *Hysteria, Sleeplessness, Want of Appetite, Tremors, Depression of Spirits, Cured by Suggestion in Two Séances.*—Mlle. X——, aged 27, an intelligent lady who had enjoyed good health and spirits, and was free from hysteria until August, 1885; at that time she had a disappointment which changed everything.

In February, 1886, she consulted Dr. Bernheim. She had then suffered for months from complete want of appetite, sleeplessness, giddiness, especially on lying down, terrible dreams when she did sleep, and slight muscular tremors in the limbs, so that it was not easy for her to keep her hand steady. She had been treated with bromides and antispasmodics without success. He hypnotized her, and she slept easily and profoundly. He suggested the disappearance of all her troubles, and after two séances all the morbid symptoms had disappeared, she slept well, and ate with appetite. Her spirits were as good as ever. Dr. Bernheim adds that she remained well.

Case V. *Intermittent Pseudo-Paralysis of the Lower Limbs, with Convulsive Trembling of the Legs for nearly Four Years, Cured by One Hypnotic Suggestion.*—Madame S——, aged 26. After much domestic trouble and a bad miscarriage, this lady completely lost the use of her lower limbs for three months. The paralysis disappeared as suddenly as it came, but returned again in a few weeks. These intermissions and relapses followed each other every few weeks, up to the time Dr. Bernheim saw her, for nearly four years. She had undergone all kinds of treatment—including electricity and massage—at the hands of the most eminent neurologists

of Paris, but nothing seemed to shorten the terms of paralysis or to avert them. On May 29th, 1887, Dr. Bernheim was sent for to Paris to see her. He found her perfectly free from the ordinary symptoms of hysteria, in good general health, without any organic disease, and unusually bright and intelligent. While lying down she was able to move the legs perfectly well, but when Dr. Bernheim made her attempt to stand she at once collapsed, and would have fallen to the floor had she not been supported. On moving the legs they were seized with tremors, over which she had no control.

He found the reflexes normal and all the functions perfect.

On being hypnotized she fell into a light sleep, during which she was conscious of everything going on around her. On being aroused she denied having been at all influenced. Dr. Bernheim, while she was in the hypnotic state, moved the legs, and told her she would be able to stand and walk quite well when he told her to try.

After the operation he insisted on her making the attempt, and, to her surprise, she was able to both stand firmly and walk with confidence.

He hypnotized her again the next day, when she fell into the third stage of sleep, and the suggestions were repeated.

Madame S—— had been suffering from the present attack for six weeks when Dr. Bernheim was called in. He had opportunities of seeing the patient at intervals afterward, and there was no relapse.[28]

Case VI. *Writer's Cramp for Three Years; Rapid Improvement; Temporary Relapse; Finally Cured by Suggestion.*—H. C——, aged 47, an accountant, consulted Dr. Bernheim November 18th, 1885. He was healthy and strong, and in no wise nervous or hysterical. Three years before he began to feel symptoms of the malady. After writing a few lines all the fingers became contracted, and he had to desist for a time. At first he was able to write again after a short rest, but gradually the cramp became worse, so that he was unable to sign his own name. By means of various devices he contrived to go on a little longer, but at the time he consulted Dr. Bernheim he had been compelled for three months to write with his left hand. He was hypnotized, and at once fell into the third degree of sleep. Dr. Bernheim suggested the disappear-

ance of the cramp. On awaking he was able to write two lines and a half without cramp. The next day he wrote eight lines without cramp.

On November 21st the patient was able to write a business letter, and only complained of feeling heaviness in the wrist and a slight tendency to flexion of the fingers.

On November 24th the improvement was still maintained, and Dr. Liébault took charge of the case during Professor Bernheim's absence for two months. In the middle of September a relapse took place, and the patient again became unable to write more than a few lines. He left off treatment, until January 29th, when he again consulted Dr. Bernheim. Improvement now rapidly set in and progressed until, on March 2d, he finally discontinued treatment, being perfectly cured. He has gone back to his office, and writes all day long without fatigue or cramp.[29]

Case VII. *Rheumatic Pains in the Shoulder-joint for three or Four Months, completely Cured in Two Séances.*—Emile L——, aged 61, glass-maker, consulted Dr. Liébault November 30th. He had never suffered from rheumatic fever, but nine years before had had sciatica for three years.

When seen, the pain was in both the shoulders, but especially the right one, at the place where the collar-bone articulates with the scapula. There was also a tender spot above the anterior superior spine of the ilium on the left side. It was most felt on stooping. Besides all this there were pains in both knees. The patient was hypnotized, and fell into a light sleep. On awaking the pains in the knees were gone, and those in the shoulder were much better. He had been unable for three weeks to dress himself, but now he was able to do so.

On November 3d he was again hypnotized, and again slept lightly. He awoke perfectly cured, and remained so.[30]

Case VIII. *Articular Rheumatism for Three Months, Cured by Suggestion in Two Days.*—Jeanne M——, aged 17, consulted Dr. Bernheim August 3d, 1887. She was brought to the hospital in a carriage, and into the consulting-room supported with difficulty by two persons, being quite unable to stand alone. She was lymphatic, pale, and thin, and had

had an attack of hysteria brought on by chagrin some months before.

Since May she had suffered from subacute rheumatism, which had gradually and steadily become worse.

Dr. Bernheim found that both wrists were extremely painful, but not swollen. The first joints of the fingers were greatly swollen and acutely painful on pressure. The left knee was slightly swollen and very tender. There was also pain below the right ankle and in the joints of the toes. The spine was tender on pressure.

There was also amenorrhœa, leucorrhœa, and sleeplessness. The patient was hypnotized and fell into a sound sleep.

On August 6th, after two séances, she felt very much better. She slept well, had a good appetite, and had hardly any pain. The swelling of the joints had almost entirely disappeared, and there was only tenderness on pressure. She was again hypnotized, and the suggestion made that she should feel no more pain.

On August 8th she returned completely well and cured of all the symptoms, was able to walk perfectly and without any pain, and was altogether a changed person.[31]

Case IX. *Neuralgia of the fifth Nerve for a Year, with Tic douloureux for a month; Rapid Improvement and Cure in Ten Days.*—Charles X——, aged 60, entered the hospital July 27th, 1885. His trouble had commenced a year before with pain in the right side of the nose. The pain came on several times a day, and lasted from a few minutes to several hours. Since four weeks the pain had spread to the eye, the forehead, and all the right side of the face. It was very acute, and came on in paroxysms every hour or two, and lasted about half an hour. In the intervals there was no pain, but only a feeling of burning. There was lachrymation during the attacks, and they were also accompanied by convulsive movements of the face.

The patient was strong and well otherwise for his age. Dr. Bernheim found the points of exit of the branches of the fifth nerve sensitive to pressure, and all the right cheek tender to the touch. On July 28th, the first attempt to hypnotize him was unsuccessful; but on July 30th he was successfully operated on, and when he awoke he felt much better. In the after-

noon he had paroxysms of pain, but less intense, and he slept better that night than he had done for weeks.

He was hypnotized about every second day until August 9th, by which date he was perfectly cured, and he remained well.

CASE X. *Sciatica for Seven Weeks, Cured by Suggestion in Six Days.*—Joseph L——, aged 44, shoemaker, was admitted into the hospital under Dr. Bernheim, May 15th, 1885. He was a weakly person of lymphatic temperament and with emphysema. He had continual pain along the course of the sciatic nerve of the left side, and this was everywhere painful on pressure, aggravated by sitting, and especially by lying down in bed. The leg felt heavy and numb, and the pains, which were pricking in character, radiated from above downward.

On May 20th he was hypnotized, and fell into the third degree of sleep. He felt better on awaking, and the curative suggestions were repeated daily until the 26th. Each day he became better, and in a week was perfectly cured. He had previously been treated with medicated baths at the hospital for three days without much effect.[32]

CASE XI. *Nocturnal Enuresis from Infancy, Cured by a Single Suggestion.*[33]—Jacob S——, aged 17, of weak intellect, but strong and healthy, had always suffered from the above complaint. He had control over the functions during the day, but nearly every night he suffered from incontinence.

He consulted Dr. Bernheim December 28th, and was hypnotized with great readiness. Suggestions were made to him while in a state of profound hypnotic sleep that he should awake several times in the night, and leave the bed.

He returned to the hospital, but required no further treatment, for the malady was at once cured, and did not reappear. (All practitioners of suggestion agree that the system is absolutely specific in the treatment of this troublesome complaint uncomplicated by organic defects.)

CASE XII. *Amenorrhœa. Suggestion that the Function should Reappear an a Certain Day. Successful Result.*—Mlle. C——, aged 25, teacher, consulted Dr. Bernheim November 17th, for the above-mentioned trouble. She had seen nothing since 7th October, and in consequence she felt distended, a

sense of constriction round the waist, and other symptoms referred to the same cause. She was a regular patient of Dr. Liébault's, and she readily fell into a profound sleep. Dr. Bernheim suggested that the function should be re-established on November 30th, and made the patient repeat the suggestion after him.

On November 30th she came to tell him that it had happened as he suggested. He hypnotized her again and suggested December 28th for the next period. This also was realized.[34]

Case XIII. *Menorrhagia about every Twelve Days. Altered by suggestion to Twenty-eight or Twenty-nine Days and Cured.*—Madame H——, aged 35, mother of three children, the youngest of which is nine years old. Hysterical, but of good constitution. Before she had had children the period used to come on every three weeks, but for two years it had returned about every twelve or fourteen days, or even at shorter intervals. It was accompanied by pain and hysterical troubles, and was very copious. The patient readily fell into a profound sleep, and Dr. Bernheim suggested that the next should not come on until October 9th, should only last three days, and should not be accompanied by any pain.

September 27th. This was the fifth séance, and the sixteenth day since her last period. She felt premonitory symptoms of its return—such as headache, and pain in the back. These symptoms, however, passed off, and by means of suggestions repeated every second day the period was retarded until the night of October 6th and 7th, or twenty-six days. This was the first time in her life that there had been more than twenty-one days' interval, and the first time for two years that it exceeded sixteen days. It lasted three days, was unattended with pain, and was less copious than usual.

On October 18th Dr. Bernheim recommenced hypnotic treatment, and suggested that the next period should be on December 4th or 5th, and henceforth every four weeks.

It appeared at the end of twenty-four days. The treatment was continued until the following May, by which time the function was thoroughly regulated, and occurred every twenty-eighth or twenty-ninth day, without pain, or other abnormal symptoms. During the treatment a number of nervous and catarrhal symptoms disappeared.[35] (The effect of imagina-

tion and emotion in modifying the renal, alvine, uterine, lacteal and other secretions is so well known, that the striking results produced by hypnotic suggestion in their functional disturbance is not to be wondered at. In "Carpenter's Physiology" [*loc. cit.*] numerous examples are given.)

CASE XIV. *Partial Paralysis of the Left Side for Eight Days. Rapid Improvement under Suggestion, and almost Complete Cure in Three Weeks.*—Louis C——, aged 60, house-painter, was taken into the hospital November 7th, 1886. He had enjoyed good health until six days before, when he had suddenly felt a sensation of weight in the left leg. He returned home, and two hours later felt the same sensation in the left arm, accompanied by a pricking, which still continued when he entered the hospital. In the evening he was no longer able to use his left leg.

Dr. Bernheim found the temperature and pulse normal, the arteries atheromatous and rigid. The features deviated markedly to the right. The patient sat up in bed with difficulty, and was unable to fully raise his left arm, which was also weak and easily tired. He was unable to stand. When lying down he was able to raise the left leg, but could not keep it up for more than four or five seconds. The reflexes were diminished, and he was unable to bend the instep. Sensibility normal. Constipation for four days, for which he was given an enema.

On November 9th the patient was hypnotized, and fell at once into a profound sleep. On awaking he was able to hold up the left leg for ten seconds, and to bend the toes better.

He was hypnotized the 11th and 16th, with only slight effect. On November 17th, after the suggestion, he was able to stand alone, and to walk with very little assistance.

On November 19th he was able, after being hypnotized, to walk the length of the ward without help. He could hold the leg up when lying down for an indefinite time, and had quite regained power over it. The reflexes were slightly increased.

He progressed steadily every day, and was able to walk downstairs on December 2d. He still, however, felt a heaviness in the arm and leg, which prevented his using the brush or climbing ladders so well as formerly.[36]

Professor Bernheim fully describes one hundred and five

cases of many kinds of disease treated by hypnotic suggestion. Among these are several examples of grave cerebral and spinal disease, in which the treatment seemed to prolong life, and of which it certainly relieved the suffering.

Examination after death often revealed a great amount of disorganization, so that it seemed extraordinary that any treatment could bring about much improvement. He explains the good effects which attend suggestion, even where there has been extensive hemorrhage into the ventricles followed by atrophic changes, by insisting that in disease of the nervous centres, functional derangement often exists quite out of proportion to the actual lesion, *i.e.*, hemorrhage may destroy a portion of the brain substance, and this may react on the neighboring zones by setting up sympathetic irritation.

Neither suggestion nor anything else can, of course, do anything to restore the disorganized brain tissue; but it is all-powerful, he observes, in the treatment of the sympathetic and functional troubles which accompany such a condition (*op. cit.*, pp. 308–324).

Case XV. *Aggravated Hypochondriasis.*—M. F——, aged 43, has suffered for a year from this malady. She is conscious of all her internal organs, and their functions cause her painful and distressing sensations, which makes her think that they are all more or less diseased. She has lost all hope, and is persuaded that she will never recover. She is debilitated and suffers from indigestion, does nothing but lament and analyze her sensations, lives in a perpetual state of agitation, and does not sleep.

She was put under suggestive treatment, and fell into a light sleep. By its means sleep was restored, digestion re-established, and, above all, her attention was gradually diverted from her sufferings, real and imaginary, and in a few weeks she was cured.[97]

Case XVI. *Acute Puerperal Mania.*[98]—Madame X—— has had several confinements in quick succession. The consequent exhaustion, and an attack of phlebitis with fever, are the chief causes of the malady. After the first fifteen days, during which her life was in danger, the excitement and tendency to violent and purposeless acts were no longer continu-

ous, but alternated with comparatively lucid intervals. Dr. Godet found that he could sometimes cut short attacks by suggestion. He suggested that she should remain tranquil, and should not open her mouth. In this way he calmed her in a remarkable manner, and the attacks soon ceased, and she was cured.

CASE XVII. *Hysteria, Tendency to Tetaniform Spasms, Insomnia, Morphia and Chloral Habit.*[39]—Madame K—— was admitted for treatment, suffering from the above conditions.

Hypnotic treatment combined with suggestion was employed to combat them. The narcotics were gradually discontinued, the spasms ceased, and natural sleep was regained by degrees, so that she was dismissed cured.

Braidism was tried without suggestion at first, but it only aggravated the symptoms.

CASE XVIII. *Moral Depravity in a Boy, Cured by Suggestion.*[40]—On June 9th, 1888, M. F——, a youth aged 16, was brought to Dr. Voisin at the Salpêtrière. From the age of six or seven he had been incorrigible. Not only did he tell lies, steal, play truant, and behave ill generally, but he also tried to corrupt all the children with whom he came in contact. He became worse and worse as he got older, and was turned out of several institutions into which his mother had procured his admission. (Dr. Voisin describes some of his vices, which are unfit for repetition, and which prove the youth to have been utterly depraved and bad.) On examination he was found to have an internal squint of the left eye, nystagmus, and haziness of the cornea. The tongue deviated to the left. Otherwise he was well-made and healthy. He read with difficulty, and was very ignorant, though his memory and power of observation were sufficiently good.

Dr. Voisin endeavored to hypnotize him, but was not successful until the third séance. Once asleep, suggestions of moral reform were made.

He began to improve at once, and by July 6th the youth was absolutely transformed. The wish to do evil first disappeared, and was then replaced by a desire to do right. His insubordination and disobedience had given place to a wish to

please his mother. He expressed to Dr. Voisin the happiness he felt at being thus changed. He saw the doctor again on October 6th, six weeks after the discontinuance of the treatment, and the cure was maintained.

Dr. Bernheim and Dr. Liébault give several instances of cures of moral diseases. The former, after describing a somewhat similar case to the above, asks if he can be accused of tampering with the child's free-will because he has repressed his bad qualities (*op. cit.*, p. 357).

Case XIX. *Migraine for Four Years, Cured by Suggestion.*—Madame A——, aged 28, a widow with four children, consulted Dr. Liégeois in September, 1887. She suffered from daily attacks of sick headache. She had two attacks daily, the first between 5 and 6 in the morning, and the second in the afternoon, between 3:30 and 4:30. Her health was deteriorating in consequence, and life had no attraction for her. She was easily hypnotized, and Dr. Liégeois suggested that there should be no pain that afternoon. She returned in the evening to tell him that she had passed the afternoon without an attack, and to be again hypnotized. Dr. Liégeois now suggested that there should be no pain the next morning nor henceforth.

At the time of reporting this case it was a year since he made that suggestion, and the lady has continued all the time free from migraine.[41]

Cases Contributed by Dr. Van Eeden, of Amsterdam.

Case XX. *Neuralgia of the Neck and Left Shoulder. Paralysis of the left Arm and Leg, of Syphilitic Origin.*—A. H——, aged 34, is a strongly-built man, with an originally good constitution. He became infected eight years ago. Thirteen months ago he was suddenly attacked with total loss of power in the left arm and leg.

On October 9th he consulted Dr. Van Eeden, and was then suffering from severe pain in the neck and left shoulder, which had lasted two months. The pain prevented his sleeping more than an hour or two at night. He had partially recovered from the paralysis, but for five months no progress had been

made. He was unable to fully raise the left arm, to open the hand, or extend the fingers. Antisyphilitic treatment had produced no effect for some months.

The patient was hypnotized in the usual way, and the second degree of somnolence (slight catalepsy) was produced. While in the hypnotic state suggestions were made to lessen the pain, and the rigidity of the semi-paralyzed limbs was relaxed by suggestions and active and passive movements. On awaking, the pain was found to be much relieved, and at night he slept four hours.

The treatment was continued daily for six weeks. By October 12th the pain had entirely disappeared, and he enjoyed eight hours' sleep every night henceforth.

Movements were constantly employed during the hypnotic state, and power gradually returned to the limbs, so that by November 8th the patient could extend all the fingers of the left hand, and keep the arm in a horizontal position for a considerable time. When treatment was discontinued after six weeks he could make all the movements of the arm and hand freely. His walking power had also greatly increased.

CASE XXI. *Cephalalgia, Gastrodynia, Dyspepsia.*—The patient, a little girl of eight, is a delicate child, and has suffered from continuous headache, want of appetite, and pain in the stomach. She rises nearly every day with a bad headache, and twice or thrice a week she is obliged to stay in bed on account of the pain. The stomach pains occur irregularly, last only a short time, and are very severe. She never has had a good appetite. Once only has she been free from pain—about three years ago, for a fortnight.

On September 16th the child was hypnotized by Dr. Van Eeden for the first time. The sleep produced was profound, as is usual with children. In the first sitting the pain was quite removed by suggestion, and did not return for two weeks, though there was only one consultation. Since September 16th she has only twice had headache, and this was each time at once removed by suggestion. The child remains under treatment, as such cases necessarily require a long course. There has been no pain in the stomach since her first visit, the appetite is better, and the child's general health more satisfactory than it has been for years.

Case XXII. *Chronic Alcoholism.*—M. G——, a well-to-do man of 49, had for sixteen or seventeen years constantly drunk alcohol to excess. He has never during all that time given it up. On his best days he has only taken four to eight glasses of cognac, but mostly he has drunk twenty or more. He has had several attacks of *delirium tremens*, and his mental faculties are much deteriorated. He is unable to apply himself to any business requiring thought or attention, and is unable to write his name. His face is covered with pustules of acne.

On September 27th he was hypnotized, and fell into a light sleep. Dr. Van Eeden suggested disgust for stimulants and increased strength of will. During the sleep the patient was persuaded to promise solemnly to leave off alcohol. He was also treated with arseniate of strychnia, four to eight milligrammes daily.

The treatment was continued daily for a week, then once a week for two weeks. After that no further suggestion was needed. From the time of the first sitting the patient took not a drop of alcoholic liquor, and though offered wine he refused it. Some restlessness and malaise were felt the first week. On October 4th he was able to write his name and to resume his business. Now (after two months) he feels quite well and strong, and is confident of being able to keep his promise. The acne is cured, and he sleeps and eats well. He continues to visit Dr. Van Eeden from time to time as a precaution.

In communicating these cases Dr. Van Eeden says "they are selected from many similar ones. My results are the best in the treatment of various nervous diseases, but the cases are too long to report. I may add that according to my own experience the effect of psychical treatment is best seen in the following diseases: Neurasthenia, nervous debility, eneuresis nocturna, slight or incipient brain troubles, morphia habit, alcoholism, bad habits in children, hysterical paralysis, nervous dyspepsia, anæmia, stammering, chorea, sleeplessness, nervous asthma. Combined with systematic movements during the hypnotic sleep, the treatment is also effectual in paralysis caused by apoplexy or embolism, and in infantile paralysis (poliomyelitis anterior acuta), if not of too long standing."

Drs. Van Eeden and Van Renterghem practised treat-

ment by suggestion among the upper and middle classes of Amsterdam for two years, during which time they have applied the system in nearly two thousand cases. They were both previously for many years in ordinary practice, and their testimony to the value of hypnotism and suggestion is therefore of great value.

CASE XXIII. *Neurasthenia with Deficiency of Saliva and Constipation for Thirty-five years, Cured by Suggestion.*[42]—Madame V——, aged 55, consulted Dr. Burot in August, 1888. She had for many years carried on the business of weaving hemp, and it had been her habit to moisten the thread with the saliva. When about twenty years of age this secretion showed signs of drying up, and at the same time obstinate constipation appeared. She lost her appetite and became anæmic, constantly drowsy, extremely weak and feeble, and altogether a confirmed invalid. At forty the change of life occurred, but it made no improvement in her health, which became worse and worse.

Dr. Burot found her suffering from pains all over the body, general malaise and anæmia. The tongue was red and dry, with prominent papillæ. There was great dryness of the mouth, very deficient digestion, and obstinate constipation. The stools were infrequent, and their passage caused intense pain. The dryness of the mouth often prevented sleep. Dr. Burot hypnotized her and suggested increased flow of the digestive secretions, and at the same time gently rubbed the salivary glands and the abdomen.

After a month's treatment the patient was cured. The mouth became moist, the saliva abundant, digestion easy, and the bowels regular and comfortable. At the same time the general health was re-established, and she grew stouter and quite strong.

* * * * * * * *

I had intended to add here a short chapter giving my own experience of the treatment, but the bounds originally fixed for the little book have been already exceeded, so I shall confine myself to a few remarks.

The results I have obtained in my own practice completely confirm the estimate of the value of suggestion as a means of cure which I had formed from watching the practice of others.

In many cases of neuroses—slight as regards the pathological signs, but serious enough from the patient's point of view—such as toothache, headache, rheumatic pains, neuralgia, gastralgia, etc., the relief has been almost immediate and most marked. In chronic cases, many of which have been under my care for years, I find hypnotic suggestion a most useful auxiliary in relieving pain, sleeplessness, restlessness, palpitation, and most other subjective symptoms. In the worst case of ulceration of the stomach I have ever seen, the patient, an anæmic girl, was immensely helped by it; and though it required milk diet and bismuth to make a complete cure, the duration of the disease was shortened, and the suffering attending it was mitigated to a very great extent. A case of telegraphist's cramp, of at least a year's duration, was entirely cured in three séances. In four or five cases of dipsomania, in both sexes, I have found it achieve results which nothing else could; and it is in the treatment of these "moral diseases" that, I am confident, the greatest value of the system will be seen.

My opinion of its probable value in acute disease has been very much strengthened by a case I recently attended. A young woman, a particularly good subject for suggestive treatment, was apparently seized with rheumatic fever. Her temperature mounted to 104°; she had acid perspiration, intense pain in the head and in many of the joints. The ankles and wrists were greatly swollen and very tender. The pain was so severe that she had had no sleep for twenty-four hours when I saw her, and her condition of mixed restlessness and weariness was distressing to witness. On several occasions I had hypnotized her for various troubles, and I now immediately attempted to produce sleep by suggestion. The pain, however, was so great that it took fifteen minutes to induce a light sleep. I left with instructions not to awaken her, and she slept for about an hour. She awoke refreshed, and slept at intervals during the night. On visiting her the next day I found the temperature 101°, and the pains very much alleviated. This time she was hypnotized with greater readiness, and she slept for more than two hours. I suggested that she should awake free from pain, but I confess I hardly expected to find my suggestion successful. To the patient's great surprise, she was really free from acute pain when she awoke,

and she was able to sit up and move the limbs without feeling anything more than stiffness and lameness.

In two days she was completely cured, and the rheumatic pains which had been flying about the joints for weeks did not return.

In this case, as in many others, the attainment of sleep without drugs was in itself of immeuse advantage, and the suggestions certainly removed all the pains of neurotic and sympathetic origin. (I have recently treated a case of partial insomnia. The patient, a scientist of great intellectual power, had for years been unable to sleep after 3 A.M., no matter at what hour he retired to rest. A short course of suggestive treatment has cured this morbid habit, and he now sleeps uninterruptedly, until 6 or 7 o'clock. This patient was only slightly influenced by hypnotism—*i.e.*, to the "first degree.")

My appreciation of the efficacy of drugs has been intensified since studying hypnotic suggestion; for I have seen on several occasions a properly selected remedy remove a symptom which suggestion had left untouched. Dr. Van Eeden has shown how the beneficial effects of massage and Swedish gymnastics are increased in certain cases by being combined with Dr. Liébault's system.

That hypnotic suggestion is destined to play henceforth an important part in the treatment of disease and the alleviation of human suffering is evident, and enlarged observation will show what it can and what it cannot do. If such a "gift of healing" were allowed, in consequence of the neglect of men of science, to fall into unworthy and incapable hands, it would be a national misfortune and disgrace; but the truth has only to be pointed out to render such a consummation impossible. Of this I am confident.

APPENDIX.

NOTE 1.—FOR PAGE 731.

I AM informed on the best authority that in the initiatory rites of several secret societies the candidate is submitted to a somewhat similar ordeal. He is told that he must submit to be bled. His eyes are blindfolded, his arm is pricked, and a stream of warm water is allowed to trickle down it.

The surroundings at the same time being mysterious and awe-inspiring, a very great effect is produced on nervous and sensitive subjects. Syncope and nervous exhaustion not uncommonly follow the ceremony, and the new member may be made ill for days.

The rite is, no doubt, an example of the survival of the form after the unpleasant reality has, in deference to civilization, been allowed to fall into disuse.

NOTE 2.—BRAID, OF MANCHESTER.

James Braid used to throw his patients into a kind of sleep or trance by making them fix their eyes and attention on a bright object—generally his lancet-case—held a few inches above the eyes. He found this caused fatigue of sight and abstraction of mind, which, in nearly all cases, induced the condition he termed *hypnotism*.

He practised his system successfully for many years at Manchester, and wrote several books in which he fully explained it.

But it seems to have died with him, and it is only now that *suggestion* with hypnotism has come so prominently before the profession that his works begin to be largely read. The most important one "Neurypnology" (London, 1852), has been recently translated into French by M. Jules Simon—an al

unique honor, I imagine, for a foreign medical author n
thirty years after his death.

Braid found hypnotism increased the heart's action to
an extent that he warned medical men against using it
heart disease was suspected. He found it impossible t
children to keep their eyes fixed on his lancet case for the
essary four or five minutes, and therefore regarded the
insusceptible. We have seen, on the other hand, that su
tion finds its best subjects in children between the ag
three and fourteen, and in heart disease it is one of the
successful means of calming and reducing irregular h
action. Braid went near to discovering the truth which
bault, a few years afterward, thought out, and introd
to the world.

Note 3.—Duration of Hypnotic Sleep.

In order to arrive at the solution of this, Professor B
heim allowed many of his patients to "have their sleep o
He found its average duration was three or four hours,
as with natural sleep, it varied with individuals and circ
stances.

On several occasions it lasted fifteen, and once eight
hours. In all cases the patients awoke fresh and comfortal

Note 4.—Theory of Professor Delbœuf.

Among the numerous theories which have been advan
during the last few years to account for the influence of h
notic suggestion in organic functions, that of Professor D
bœuf, of Liége,[43] deserves notice on account of its ingenui
He supposes that in an earlier state of existence the orga
functions may have been under the control of the will a
consciousness, but that in process of evolution the increasi
influence and attraction exerted by the environment cau
this controlling power to become weaker, and fall into ab
ance.

In the hypnotic state the faculties are no longer occupi
with external things, but may be directed and concentrat
on one or more of the internal organs or functions. Then t
power which has never been completely lost is again exerci
for a short time.

As showing that control may still be exerted at times over organic processes, he relates how during a long dental operation he was able to restrain the salivary secretion by directing his attention and will to the function. The cases of Colonel Townsend and the Indian fakir, cited in Chapter I., also illustrate this theory.

Dr. Delbœuf goes on to say that in a state of perfect health the organs and functions work harmoniously, and it is to our advantage to know and feel nothing about them; but when organic life ceases to be normal, and when some function is deranged, it would be useful to be able to bring the will and attention to bear on the affected part. Hypnotism, by setting free the attention from the "life of relation," with which in the normal state it is preoccupied, renders this possible, and enables the mind to resume its knowledge, and the will its control.

Note 5.—Some Phenomena of Hypnotic Somnambulism.

Many extraordinary and, at the present time, inexplicable phenomena can be produced in subjects who attain the last degree of hypnotic somnambulism.

Such persons are but rarely met with, and are, I believe, always of hysterical temperament, which is generally combined with a tendency to phthisis, scrofula, or other chronic disease.

These phenomena, as has been already said, are of purely psychological interest, and should be kept entirely distinct from therapeutic suggestion.

Among Dr. Liébault's patients at Nancy is a young woman named Camille, a favorite subject for experiment, as she readily falls into the most profound state of hypnotic somnambulism.

Like many hysterical persons, she takes a pride in her infirmity, and therefore, without being over-sceptical, one may wish to verify the experiments tried on her. One of the most curious of these is the production of *negative hallucinations* by suggestion. Camille, and one or two other persons of the same nervous temperament, would be told that on waking they would not see So-and-So, though he might speak to h touch her, and even prick or pinch her, and the suggestion

realized. Or they would be told that the door was no longer existing, in which case, though apparently quite awake, they would seek in vain to cross the threshold until the spell was removed.

On my return to London I was fortunate enough to meet a lady who takes a great interest in the subject, and is at the same time susceptible of being thrown into the most advanced stages of hypnotic somnambulism. Her husband is a man of science, and also much interested in hypnotism. They were both quite ignorant of the phenomena I wished to produce, and the conditions therefore were perfectly satisfactory.

Mrs. H—— is about thirty years of age, small, slight, and a blonde. She is highly nervous, and occasionally hysterical, but she enjoys good health, is intelligent, and active in her household duties. On the first occasion I tried to develop a negative hallucination; her husband was confined to the room with a bad cold, and was sitting by the fire in an armchair a few feet from her. I hypnotized her, and told her that in waking she would not see him, would not hear him if he spoke to her, and would not feel him if he touched her. All this was literally realized. She was apparently wide awake, and yet when I asked her where her husband was she said she didn't know, but thought he had gone upstairs and would be down very soon. He spoke to her, calling her by name, and asked her to get his medicine, to stir the fire, what there was for supper, and a number of other questions. She gave not a sign of having heard; in fact, she evidenty did not hear him, though she conversed with me intercurrently quite rationally. Mr. H—— then approached her, touched her hand, sat down beside her, and talked; but evidently for her he had ceased to exist, as she betrayed not the faintest consciousness of his presence. I then asked Mr. H—— to speak impersonally, and he said, "Mrs. H—— will now go to the table, take up the doctor's gloves, and try them on." She did not appear to hear, but in a few moments she got up, went to the table, and tried on my gloves—a thing she would never have thought of doing of her own initiative. I asked her why she did this, and she replied, "I don't know; I thought I should like to." She was not aware that the impulse proceeded from another. When I blew on her eyes and said, "Mrs. H——, there is your husband close beside you, and you can see him now," she looked fixedly

at his chair for a moment, and then said, "Yes, I see him now, but where was he a minute ago?" adding, "At first he looked small and indistinct, but now it is all right." We know we may look at a thing and yet not see it when in a "brown study," or preoccupied with something. A familiar example of this is afforded by observing how absent-minded people pass their friends in the street without recognition, though their eyes may dwell on them for some time. Afterward they will deny having seen them, and truly they have not. "Eyes have they, but they see not." A physical impression has been made on the retina, but it has not undergone that cortical co-ordination or registration in consciousness without which there can be no perception.

I had only learnt that morning, from reading an article by Professor Liégeois [4] the curious fact that in hypnotic somnambulism the subject will carry out a suggestion made by a person whom she is prevented by some inhibitory nerve-action from apparently either seeing or hearing. The same lady kindly allowed me to try other simple experiments on her. She was ignorant of the nature of them, and only stipulated that they should not make her appear ridiculous or cause much pain. When in the hypnotic sleep I gently touched and kept my forefinger on a small surface of the wrist, saying while I did so, "Poor Mrs. H—— has a nasty burn on her wrist, probably from some boiling-water; the place is very red, and rather painful." In a few minutes I awakened her, and she immediately began rubbing her wrist as if in pain there. On my asking her what was the matter, she replied, "I think I must have spilt some boiling-water on my wrist; it feels as if I had burnt it." On looking at the spot, there was a very perceptible patch of redness about the size of a sixpence, and every moment this became more defined and angry-looking. As the pain was increasing, it would have been a breach of our agreement to protract the experiment, so I hypnotized her once more, and told her that there was no burn, and that the redness and pain would be quite gone when she awoke. In point of fact, a very short time was sufficient to disperse the morbid appearance, and on re-awakening her there was no complaint of discomfort. The same lady after the first operation complained of chilliness and stiffness, but I had only to suggest in future séances that she was not to feel these un-

pleasant symptoms to insure her not being troubled with them.

These experiments belong in no way to therapeutic suggestion, but are of interest as they show how exactly the phenomena producd at Nancy may be reproduced by experiment in England.

Dr. Luys, physician to La Charité Hospital, Paris, showed some extraordinary experiments on a somnambulic and hysterical subject before the profession in October, 1888; and in the same month Dr. Vizioli gave a similar demonstration before the members of the Medical Congress assembled in Rome.

The importance of hypnotism as a means of investigating psychological problems is recognized by many eminent psychologists on the Continent. Binet and Feré, in their work already referred to,[45] say: "Hypnotism seems to us to fill a void. . . . Associated with the clinical observation of mental and nervous diseases, it will give to the new school of experimental psychology the methods it needs, and will furnish an explanation of phenomena based on experiment."

Note 6.—Dr. Liébault's Classification of Hypnotic Sleep.

First Degree.—The patient feels a heaviness of the eyelids and a general drowsiness.

Second Degree.—This is characterized by suggestive catalepsy. When the operator places the arm in a certain position and says it is to remain there, it is impossible for the patient to put it down. It remains rigid and fixed for a much longer time than would be possible in a natural state. In these two degrees consciousness remains almost complete, and often the patient denies having been in the hypnotic state because he has heard and remembers every word which has been spoken to him. A very large proportion of people never pass beyond this stage.

Third Degree.—In this the subject is also conscious of everything going on around him to a certain extent, and hears every word addressed to him, but he is oppressed by great sleepiness. An action communicated to a limb is automatically continued. If the arm is rotated to begin with, it goes on turning until the operator directs its stoppage.

Fourth Degree.—In the fourth degree of hypnotic sleep the patient ceases to be in relation with the outer world. He hears only what is said to him by the operator.

The *Fifth* and *Sixth Degrees*, according to Liébault, constitute somnambulism. In the former, recollection of what occurred during sleep is indistinct and recalled with difficulty; on the latter, the patient is unable to recall *spontaneously* anything which has occurred while asleep. All the phenomena of post-hypnotic suggestion can be induced in this condition, and it presents features of extraordinary interest to the psychologist.

Though spontaneous memory is extinct, it can be evoked by hypnotizing the subject and asking him what happened in the previous sleep. Even in this rare and helpless condition, therefore, one has a check on abuses which can always be brought into use, and which might play an important part in legal or criminal cases.

A very well-known and scientific physician, Dr. Grazzini, of Florence, has been kind enough to send me the following letter, giving full particulars of the case alluded to on page 741. It is so interesting, from a psychical point of view, that I feel impelled to translate and publish it *in extenso*, though it must be understood that such phenomena lie outside psycho-therapeutics as a system of treatment. In England we rarely, if ever, see such cases; but I believe that they are not uncommon among the Latin races. The hysterical Frenchman, known as the "Soho Sleeper," occasionally arouses scientific curiosity by indulging in fits of prolonged trance or somnambulism. In November, 1888, he had one of these fits, which lasted for thirteen days, during which time he was susceptible to suggestions of various kinds. Dr. de Watteville, for instance, made him the subject of delusions, in order, as he tells me, to prove to the police the indiscretion of allowing all sorts of people to have access to him.

In England we frequently hear of "fasting girls," and I imagine these cases fall into the same category as "sleeping men." As will be seen from Dr. Grazzini's letter, suggestion was actually curative in this case of "spontaneous hypnotism."

"The following case of spontaneous hypnotism may interest you. G. F., of Alessandria (Piedmont), aged 32, of feeble constitution and delicate appearance, with a pallid and beard-

less face, is by occupation a travelling conjurer. I can eas
hypnotize him by making him look steadily at one of my f
gers and telling him to sleep. Occasionally he spontaneou
falls into the same condition if a ray of light strikes his e
when in the streets or when entering a brilliantly-lighted roo
[The man was subject to these attacks of spontaneous hypn
ism previous to his having ever been hypnotized. The conditi
is not very uncommon among hystero-epileptics.—C. L. T.]

"I think it may be called a case of advanced (*grand*
hypnotism, for the various phases are developed in regul
and characteristic succession.

"In the lethargic stage all the limbs are in a state of
laxation, and there is marked nervo-muscular hyper-excit
bility; the slightest pressure on or even touch of a nerve
muscle causes a corresponding movement.

"On raising the eyelids, he immediately passes from t
lethargic into the cataleptic stage. He can then be placed
the most difficult and impossible positions, as though he we
made of wax, and in these he will remain as long as desir
without strain or fatigue. If the right eyelid alone be raise
that side of the body only becomes cataleptic, and, the oth
side remains in the lethargic state, and *vice versâ* if the le
eye be opened. Slight pressure on the top of the head caus
him to fall into somnambulism, and in this state he is su
ceptible to suggestions. For instance, I suggested to hi
that on awaking he would be unable to speak or to move
limb; and this suggestion was realized, and his speech an
movements were paralyzed until I removed the prohibitio
Again, at my suggestion, he went to places which he did n
know, and called on people who were strangers to him, at th
hour and on the day I had named. He came to the studio
an artist friend of mine at the exact time I had suggested t
him eight days previously, and on being asked why he di
this could give no reason, and was surprised and annoyed a
having gone there, for he had an engagement for that time a
a neighboring village. It was on that occasion I induced
state of somnambulism, and suggested his copying a hea
drawn by my friend [alluded to on p. 742]. He reproduced th
drawing with the quickness and facility of a real artis
whereas his attempts at drawing when awake are childis
scrawls, as you will see by the photographs I send you. [D

Grazzini has sent me photographs of some of this man's drawings when awake and when in a state of somnambulism. He has also given me copies of his letters, written in his own person, which are what one would expect from a peasant; and others when, while in a state of somnambulism, he had been told that he was (1) a general in the army, (2) a grandmother, (3) a small boy. These letters are quite in keeping with the supposed position.]

"I determined to repeat on this susceptible subject the experiments shown by Dr. Luys before the Academy of Medicine of Paris, exhibiting the influence exerted by drugs on a hypnotized person at a distance. Without in any way entering into the controversy excited in the Academy by these experiments, I can only say that on holding glass tubes, which I had filled with tartar emetic or ipecacuanha, near the subject's back, he being in a state of somnambulism and ignorant of my proceedings, he was *invariably* attacked by nausea, agitation, and violent fits of vomiting. These symptoms ceased as soon as the tubes were removed. When the tubes were prepared by a third person and covered with paper, so that I was myself ignorant of the nature of their contents, he no longer showed the physiological effects of the drugs used, but only vague symptoms, such as muscular contractions, more or less violent, or various emotions. I should add that these experiments were repeated in the presence of my colleagues and friends at the hospital of the "Fate bene Fratelli" (in Florence), to which G. F. had been brought, and where he was a patient in my ward. [The result of the deliberation of the Academy on these experiments was, that they decided that the so-called effects of drugs at a distance depended upon the subject in some way guessing the nature of the drug contained in the tube, and acting accordingly. In these highly nervous subjects the senses are wonderfully acute in somnambulism, and the slightest hint by word or gesture excites the *suggested* effect.—C. L. T.]

"While in the hospital a large carbuncle developed on his right thigh, and, as an operation was necessary, I determined to avail myself of hypnotism to procure anæsthesia. A deep incision was made and the cavity was scraped and cleansed, while he was in a state of lethargy, without the faintest sign of suffering, and on awaking [illegible] east idea that he had been operated on.

"I had observed that a magnet applied along the spine and to the head arrested the lethargic and cataleptic states, and it occurred to me that it might be possible to cure G. F. of the morbid tendency to spontaneous catalepsy which prevented him following his business and exposed him to dangerous or criminal suggestions.

"Accordingly I suggested that he should wear a magnet of medium strength tied round his neck, and that he should buy one as soon as he left the hospital. He followed my directions exactly, and for four months was unable to remove the magnet from his neck. During that period he had no hypnotic seizure, although he was constantly exposed to brilliant light in cafés and other places where he followed his occupation of conjurer.

"But, as usually happens, the suggestion gradually lost its efficacy, and when last I saw him he told me that he had had one or two slight attacks. I believe that by occasional repetition of the suggestion this tendency might be lessened, or perhaps cured; but my treatment could not be persevered with, as he left Florence, and I have lost sight of him. [In treating such a case, Dr. Liébault would certainly insist upon the patient returning at lengthening intervals until the morbid habit was overcome and displaced.—C. L. T.]

"Before bringing this long letter to a close I must add that I have used hypnotism *as a curative agent* in a case of St. Vitus's dance. The patient, a young man, had been treated with all kinds of remedies in vain, for the disease was most obstinate. He is now entirely cured, by suggestions made by me during the hypnotic sleep. He was allowed to sleep for half an hour at a time for twelve consecutive days.

"If you think these experiences worth publishing, pray do so, and they may perhaps serve as material for researches in psychology and therapeutics.

(Signed) "G. B. GRAZZINI."

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SEXUAL ACTIVITY

AND

THE CRITICAL PERIOD IN MAN AND WOMAN,

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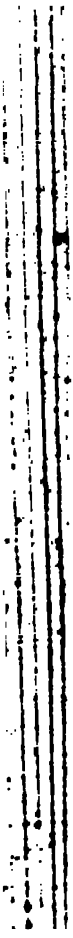


SEXUAL ACTIVITY

AND

THE CRITICAL PERIOD IN MAN AND WOMAN.

CHAPTER I.

PROCREATION, which is really only the continuance of life, consists first in the act of conception, in giving origin to the blood in the new being which is in process of formation. This blood, which is originally only a product of the maternal secretion, after having contributed to the gradual formation of the organs necessary for its perfect development, is, in its turn, renewed and contained by them from the moment of birth, which marks the establishment of its own independent life. The male and female organism is subject to the general law that presides over the essential and necessary acts of its regular and normal development; it presents, especially at certain fixed periods, changes in the blood and in the organs which, above all from a pathological and physiological standpoint, show peculiar characteristics that have always been observed; these are the evolutions due to the time of life, which under the name of the first and second infancy, adolescence, puberty, sexual activity, the critical period, old age and decay, mark the different stages of life during the time of its gradual development, its perfect formation, and its more or less rapid decline.

Among these periods of life that of sexual activity, preceded by puberty, which is only that of preparation, is distinguished by the power of procreation; it represents the essential faculty which dominates itself, the first law of which is continuity. Procreation ever represented the

sublime effort of nature in her blind aspiration after the eternity of the divine and, in spite of the attempts of a certain modern mysticism and scepticism, this aspiration has always endured, and even in ancient times the great Greek philosopher, Aristotle, expressed it very clearly as follows: "As regards things in general, some are eternal and divine, while others may or may not exist; the beautiful and the divine always, by reason of their inherent nature, elevate the things which are merely possible; that which is not eternal is nevertheless capable of existing, and it may be either less good or better. Now the soul is of more value than the body, the animate being than the inanimate; to be is better than not to be, to live is better than not to live. These are the causes which determine the generation of living beings. Doubtless the nature of beings of this order could not be immortal, but, once born, the being becomes immortal, so far as it is possible for it to be so; as regards the species this perpetuity is possible, and it is thus that men, animals and plants reproduce themselves forever" (Barthélemy Saint-Hilaire's translation of Aristotle).

The period of sexual activity is succeeded by the critical one, which is common to man and woman; however, in each of these it presents such different characteristics that hitherto practitioners have hardly admitted the existence of a critical period in man, and authors have even failed to allude to it, while there is no doubt in the case of woman, by reason of the clearly-marked sign which is peculiar to her. The changes due to age being analogous in the two sexes, the absence of the critical period in the male would be a real physiological contradiction, which it would be very difficult to justify; in fact, its existence cannot be doubtful, and it manifests itself by special characteristics which mark the sexuality as clearly as those of virile age. The presence of zoösperms in the seminal fluid, like the presence of the menses, indicates in both sexes the capacity for procreation; but, these two characteristics of sexual activity accomplish, and especially finish, their functions in such a different way, that it is easy to understand how the critical period, which has always been so accurately determined in woman, by reason of the unique and characteristic sign peculiar to her, is not established in man with that scientific certainty which it should have acquired.

The menses appear in the female every twenty-eight days, causing a periodical loss of blood, which varies very much according to the subjects, but is, nevertheless, sufficient to cause a depression of the vital forces, transient, but quite sensible. In man the secretion of the seminal fluid and of the zoösperms which constitute its fecundating element, continues, on the contrary, though varying much in its amount and above all in its power of fecundation according to the plastic forces of the blood, and also according to the more or less passionate emotions, which the power of the sympathetic affinities of love arouses in him. This secretion, furnished by the testicles, which are nourished by a very considerable plexus of vessels, which is even excessive in comparison with the size of these organs, is one of the reasons for the loss of power which is most evident and is immediately appreciable. We have a direct proof in the consequence of copulation in the two sexes; the female can, in fact, repeat the venereal act almost indefinitely without experiencing serious fatigue, and to such an extent, that she can for months and even for years do what the most vigorous man could not do for a single day. The voluptuous sensation which accompanies the sexual approach, and which is its most active stimulus, is nearly the same in the two sexes, with numerous exceptions, which usually depend on the difference in nervous excitability and above all on the psychical condition at the moment; in consequence the marked loss of power, which sometimes amounts to a true prostration that obliges the male to rest after the accomplishment of the venereal act, can really be attributed only to the loss of the seminal fluid. We know, moreover, how those are gradually enfeebled who abuse the pleasures of love, as well as those who are troubled with involuntary seminal emissions. These two points in pathological physiology have been thoroughly studied and there is nothing to be added. It is to be noted also that when the male suffers from too great depression of his forces in consequence of insufficient nourishment or from too prolonged depressing moral causes, he has very little inclination for the venereal act, which may even become impossible if these causes act so persistently as to cause too marked impoverishment of the blood, so that it has been rightly said that generation is only an extension

The peculiar mental state into which ma

accomplishment of the sexual act, has been noted from the earliest time and has been well described in the following couplet:

Principium dulce est, sed finis amoris amarus,
Læta venire Venus, tristis abire solet.

(The beginning of love is sweet, but the end thereof is bitter; Venus is wont to approach joyfully, but to depart in sadness.) This exaltation followed by indefinable depression, as the result of a physiological act so ardently desired and accomplished, is not felt by the female, who derives from it no other impression than that of an indescribable and delicious pleasure. There is, therefore, in the double sensation experienced by man the clear and well-marked indication that in the interest of his personal preservation, and above all in that of the higher end of generation, he should not abuse the virile act; its too frequent repetition would soon change the secretion of the seminal fluid that ought to remain in such a state of vitality as to insure fecundation. A true human seed, the seminal fluid is, in fact, the richest and most complicated of all the products of secretion. It is formed throughout the vast net-work of the seminal tubes, the extent of which can hardly be determined by the eye of the anatomist, and through the agency of a large amount of arterial blood. Once formed, this liquid presents a unique spectacle of living fluid, in which, to borrow the expression of Charles Bonnet, the supreme architect of the universe has sown living corpuscles, just as he has sown planets and comets in the vast expanse of the heavens (Spallanzani).

The secretion of seminal fluid being continuous, is it not evident that, if the menses did not establish an actual compensation of forces by the periodical loss of blood which they entail, the constitution of the female would very soon acquire a surplus of force, contrary to the physiological law the object of which is to maintain it in a condition of power inferior to that of the male? The facts seem to prove this clearly, because the temporary absence, or even a mere irregularity of the menses, entails serious danger to the health of the female. During gestation and lactation the menses are suppressed; the vital principles of the blood being concentrated in the nutrition of the being which is in process of formation, their persistence in both instances, entailing too great an expendi-

ture of force, would necessarily have affected the result of these two important functions, and consequently the development, and even the life, of the fœtus.

The rôle which I assign to the menses, of expressing in the female the physiological compensations of the loss of power caused by the continuous secretion of the seminal fluid in the male, would seem to be opposed by the fact that the menses are entirely absent in the female of the mammalia, the species of animals the organization of which resembles most nearly our own. But there is an essential physiological difference in their functions which has been too little noted, and which, on the contrary, confirms this absolutely and even makes the true reason evident; it is the fact that the power of procreation, which is permanent in the male and female during the entire lengthy period of virility, is merely intermittent in animals, since it can only be exercised during the relatively short period of the rut, and that in this way the loss of power experienced by the male is largely compensated for in the female during gestation and lactation, which necessarily results in securing to the male the greater power of his organization. It is a constant rule, in fact, that outside of the period of the rut, which in the mammalia marks the immediate capability for generation, sexual approaches are unknown among them, while they may occur at any time in man and woman, and that there are no other restraints than the question of power in the former. It is also to be noted that the physiological fever of the rut is confined to certain times of the year, from the month of February to the month of July, and that it never appears during the autumn and winter, while there is no season, no month, and no day in which fecundation may not occur in the human species. Observation shows, moreover, that certain climates are absolutely necessary for many species of animals, since, when transported to different climates, they lose their fruitfulness; no climate and no region of the globe is entirely unfavorable to the propagation of man. This explanation of the function of the menses is justified again by the following fact. In the most severe months of winter the menses are greatly diminished and sometimes are even arrested; a temperature of eighteen degrees below freezing causes a suppression of the menstrual flow among the Greenlanders during from three to five months of the year, because too frequently the hard-

ships of the winter's cold are aggravated by insufficient nourishment, and nevertheless *fecundation is never prevented.* In France, in the Oisans, a region among the Isère Mountains where the cold is very severe, the same observation has been made, and the suppression of the menses during from four to six months of the year not only does not disturb the health of the female, which under any other circumstances would be seriously affected, but conception always takes place during the warm season, which is invariably accompanied by the return of the menstrual flow. The same thing occurs in the mountains of Switzerland, where the winter amenorrhœa is sometimes succeeded by scanty and very painful menstruation, and even by a profuse leucorrhœa only. We cannot really attribute this result to the change due to the passing from the hard, laborious life of summer to the quiet, sedentary one of winter, since women living in a more vigorous climate are not subject to it when they can enjoy all the comforts of life. It is difficult not to recognize in such striking facts a wise provision of Nature, who thus repairs, by the complete suppression or the diminution of the menses, the excessive depreciation of the vital forces which might affect fecundation. Here is also a beautiful indication of that peculiar elasticity of the blood in the female, which is, moreover, quite necessary for the varied functions excited by conception, pregnancy, parturition and lactation; her blood would thus seem to be more plastic than that of man, when we see with what marvellous facility she repairs the menstrual losses to which she is normally subjected and that also, in spite of the very marked dangers of maternity, she lives longer than man. This superior longevity she enjoys at every stage of her existence and it is more marked, contrary to all expectation, at the critical period, which occurs in woman between forty and fifty, as compared with that in man which may be fixed at from fifty to sixty. Surprising as this fact may at first appear, it is nevertheless undeniable, as one may easily assure himself by consulting the following table of statistics, which represents the percentage of survival of males and females at every age. This table, compiled by M. Lona, chief of statistics of the Bureau of Agriculture and Commerce, confirms the statement made long since by life and accident insurance companies that the duration of life in the female is longer than that in man;

and, since this is true even of middle life, it would perhaps seem legitimate to conclude from this that man's constitution, though unquestionably stronger than that of woman, contains an active force, that at every age, and above all during the critical period, causes a drain of vital power which is in excess even of his superior organization.

Table of Statistics.

Survivals and Average Life at Every Age.

Age.	Survival. Male.	Survival. Female.	Aver. Life. Male.	Aver. Life. Female.	Average Life according to Deparcieux.
0...	100.000	100.000	40.10	43.5	39.8
1....	80.176	83.268	49.10	51.1	46.4
5....	71.642	74.420	51.7	53.0	49.2
10....	69.356	71.963	48.3	49.9	46.11
15....	68.040	70.334	44.1	45.10	43.6
20....	66.035	68.014	40.5	42.3	40.3
25....	63.101	65.709	37.2	38.8	37.2
30....	60.179	62.682	33.10	35.6	34.1
35....	57.379	59.610	30.4	32.2	30.11
40....	54.353	56.745	26.11	28.7	27.6
45....	51.163	53.866	23.3	25.0	23.11
50....	47.655	50.741	20.0	21.5	20.5
55....	43.362	47.037	16.8	17.11	17.3
60....	38.291	42.481	13.7	14.7	14.3
65....	31.973	36.251	10.10	11.7	11.3
70....	24.557	29.153	8.4	8.10	8.8
75....	16.140	19.930	6.4	6.10	6.6
80....	8.583	11.294	4.10	5.0	4.8
85....	3.163	4.511	4.2	4.0	3.2
90....	1.049	1.442	3.6	2.1	1.9
95....	313	441	2.7	1.3	0.0
100....	88	86	0.6	0.6	1.0

Virility is, to tell the truth, only the perfect development of the blood and organs, the period of life which is rendered brilliant and truly useful through the striking manifestations of the gifts of mind and heart accompanying the delicious pleasures of love and the supreme delight of maternity. The physiological differences which virility presents in the

two sexes are so clearly marked that they have through all ages attracted observation. As Madame de Staël has well said, love is only an episode in man's life, while in woman it is life itself; this is strictly true, not only from a psychical and moral standpoint, but still more from the standpoint of the physical consequences. The entire responsibility of motherhood, in fact, is sustained entirely by woman throughout the period of gestation, at the time of parturition, which is sometimes so painful, and during lactation—sucessive stages of the important act of generation, which entail cares so numerous, so constant, and at times so weighty, that the whole life of woman is completely and absolutely filled with them. However, in spite of the real dangers which delivery brings upon woman, maternity is a function so normal, so entirely consonant with her constitution that in general it is entirely favorable to the maintenance of health, so that it even improves as a rule that of young women which was previously seriously affected.

The suppression of the menses, when it occurs normally during the period of procreation, is the most important and most direct evidence of accomplished fecundation, and their monthly recurrence finds here its second justification physiologically, in that it enables us to calculate exactly the termination of pregnancy and consequently the age of the growing fœtus. From a moral and social point of view this fact is of extreme importance and, it would seem, invests with real dignity a function wrongly regarded as an infirmity of the sex.

However severe, or even brutal, may be the laws that govern the animal functions, we cannot fail to recognize the superior morality which controls the sexual approaches among civilized nations. We have a striking proof of this in the profound and exquisite sentiment of modesty in woman, a sentiment which seems to be so innate in her nature, that its absence would appear as an anomaly more shocking than a physical infirmity. In different ways man also displays his modesty in the presence of his consort and especially before his children, and it is with him one of the most delicate manifestations of the dignity and respect of home.

Of all the human passions love is the one that moves and unites souls most powerfully, the one that awakens the noblest and most generous feelings, and above all exercises the

strongest sway over the senses, to the extent of leading impassioned natures to the greatest excesses. These moral characteristics are entirely absent in animals; with them love is purely physical and, moreover, can only be present during the physiological fever of the rut. Their sexual approaches are so entirely promiscuous, that incest is habitual with them, the generative impulse being wholly subject to the brutal and imperious action of the rut, a condition which the vulgar describe very expressively by saying that the animal is "in heat." From an anthropological standpoint the physiological rôle of the menses, as well as the continuous secretion of the seminal fluid, would seem to be indications of the greatest importance, which have not been properly appreciated, and which, I think, are even positively characteristic since they have never been observed in animals. It may perhaps seem strange that the sexual function of man and woman is precisely the differential mark anthropologically which is the most striking and is the least likely to be confounded with that in animals. This fact is not without great significance, the true appreciation of which I leave to moralists and philosophers. Besides, it is unnecessary to mention with what care and minute attention throughout all ages, especially in antiquity before the Christian era, different religions have considered the subject of generation, fully appreciating its importance.

All these facts throw a vivid light upon the important part which the menses play in the physiology and pathology of woman, and it is somewhat surprising that their true functional rôle should hitherto have been so ill-defined. They were, in fact, long regarded as a purely excrementitious product, acting as a sort of purifier of the blood, the nature of which, moreover, could never be determined; subsequently undue attention was devoted to the difference in chemical composition of the blood of the female, especially to the less amount of carbon present during the procreative period as well as its renewal at the cessation of the menses, as a result of which the chemical composition of the blood approached that of the blood in man. But these changes which take place in the chemical composition of the blood in the female at certain marked periods of her existence can only be seriously regarded as one of the physiological expressions of the

change which is produced, the final cessation of the menses following, the same as their first appearance, a physiological law of her organism.

These functional differences in the blood of the two sexes do not change its general physico-chemical properties, especially those on which life positively and directly depends. "To preserve its own temperature," aptly remarks Claude Bernard, "amid the most contrary conditions, thus differing radically from inanimate bodies which ever assume the temperature of their environment, while the living body possesses the power (so long as it has not exceeded the limits compatible with life) of keeping the invariable sum of caloric necessary for the regular and constant play of the functions of the organism; whether the temperature exceeds or falls below the proper degree, the blood possesses the most powerful means of neutralizing these opposing influences and of preserving in an oven or in an ice-house, at Senegal or in Siberia, the heat necessary for its existence." The evident congestion throughout the genital tract of woman caused by the menses has led many observers to think that they were the natural and direct stimulus of the special functions developed in the ovaries for the formation of the ova, and that their rôle was thus still more increased by the great importance of this new faculty. This influence seems to me to be at least a matter of doubt. The fact of the hedjéras, or castrated females, who have been particularly referred to because their dreadful mutilation not only renders them sterile, but also usually causes a positive cessation of the menses, seems to me to be offset in a remarkable manner by that of the Greenland women and mountaineers of the Isère and of Switzerland, among whom the cold of winter, added to insufficient nourishment, causes an entire suppression of the menses, notwithstanding which they conceive at any time during this long period of amenorrhœa, as well as during the warm weather when their menses reappear normally and with their regular periodicity.

Though menstruation is the characteristic sign of the aptitude for procreation, though their normal suppression furnishes the most important evidence that fecundation has taken place, it seems to exert only a relative influence upon the formation of the ova, their principal office being to maintain,

through their monthly recurrence, woman's constitution inferior to that of man who in the order of nature ought to preserve his characteristic of active and superior power, as compared with the female, who should remain passive; there is no doubt, in fact, that the constant secretion of the seminal fluid would rapidly cause in man the loss of his superior organization and active force if his companion did not sustain the monthly loss of blood, the necessary object of which is to maintain the respective equilibrium of forces in the two sexes. The suppression of the menstrual flow during gestation and lactation, its diminution and even complete cessation, although caused during four or six months of the year by the depressing causes before mentioned, permits no doubt with regard to this question. Besides, while subjecting the health of the female so strictly to the monthly recurrence of the bloody discharge, which is the mark of her procreative power, while suspending this throughout the period of gestation and lactation, Nature in these two apparently contradictory manifestations of her sexual organization remains absolutely true to her physiological purpose, which is to utilize in these two instances the forces necessary for the formation, first of the fœtus, and then of the infant, which she originally expended in order to fulfil a plan of sexual equilibrium which was absolutely necessary. There is here a physiological action, the wonderful workings of which in the accomplishment of such a well-defined purpose we cannot admire too greatly. Certain physicians have expressed the idea that by exaggerating, in one way or another, the difference of power we might affect positively the formation of sex, and thus produce at will either sex that is desired; facts prove that there is nothing in this, and a mystery, impenetrable and providential, preserves the species by withholding from our wishes this dangerous power.

CHAPTER II.

ZOÖSPERMS appear in the seminal fluid at the age of fifteen or sixteen years, but the moment when they cease to be produced cannot be determined precisely, like the cessation of the menses in woman; and this is the principal reason why the existence of the critical period in man has hitherto failed to be recognized; moreover, the continuance of the secretion of seminal fluid, not only during the period of virility, but also during old age, has naturally diverted attention from this subject. But facts prove, nevertheless, in a positive way that this secretion of semen diminishes very greatly in quantity, and above all in its fecundating power, between the ages of fifty and sixty, since the capacity of begetting children declines to a marked extent at this time and is, so to speak, the exception after sixty; and it is precisely this unquestionable diminution in fecundity which ushers in in man the critical period. Moreover, while granting that there are undoubted exceptions in certain favored constitutions, where the period of development has been longer, as occurs in some men of ninety and one hundred years of age, whose procreative power is prolonged like their lives beyond ordinary limits, if the begetting of children is exceptional after sixty, this simply conforms to that higher law of nature which in an absolute way subjects everything in the organization of man and woman to the perpetuation of the species, and which, for this purpose, requires healthy, vigorous products capable of effecting this, which we could not really hope to meet with in old age when the body is evidently in a state of decline. It is with children as it is with ideas—one must have them when he is young and in the full possession of his powers in order to be able to train and develop them during the time necessary for their perfect progressive formation, and thus to insure the material, intellectual, moral, and social continuance of the human race.

Since the zoösperm constitutes the fruitful element of the seminal fluid, it would be extremely interesting to investigate the changes which it might present as regards its power of fecundation from the period of virility to that of decline and also those which might take place in the course of acute and chronic diseases. It is unnecessary for me to enter into the infinite difficulties of a problem which is so intricate; however, positive facts of great weight throw enough light upon this interesting physiological point to furnish the possible solution of it. Thus we have demonstrated the temporary disappearance of the zoösperms during the course of most acute affections, especially in gonorrhœa; it is not less certain that they are gradually diminished after each ejaculation, as is the amount of fluid discharged, which varies from one to eight grammes. This diminution is still more marked as age advances, although it bears a direct relation to the degree of conservation of forces in each constitution, so that the presence of several zoösperms has been demonstrated in men of very advanced age, the appearance of which did not seem to differ from those observed during the virile period. It has been inferred, with apparent reason, that man was fruitful for an indefinite period; this conclusion is evidently an exaggerated one, since facts prove beyond doubt that after the age of sixty the begetting of children is exceptional, and that the exception cannot weaken the rule.

Having been engaged for many years in seeking for the characteristic evidences of the critical period in man, I have assured myself by extensive testimony received from men who married between fifty and sixty, and whose very great disappointment at not having children had led them to submit their semen to a careful examination, that the latter presented very appreciable physical changes, which I have noted sufficiently often to be able to state the following facts: 1. The characteristic odor which is peculiar to the seminal fluid, and which is due to admixture of the prostatic secretion, is much less marked; 2. Its viscidity, due to the secretion of Cowper's glands, is diminished; 3. Its whiteness and opacity are gradually lessened until it assumes a grayish tint, which is quite marked in men of advanced age; 4. The coag of the seminal fluid which occurs spontaneously afte e it resumes its liquid form after a certain

noticed, and is often entirely absent in very old or feeble persons.

These combined characteristics, which are not yet capable of being positively proved (with the exception of the last, which is most easily demonstrated, since those who have taken the trouble to observe their semen have described it as nothing but turbid water), give the impression of a secretion which is evidently impoverished, since it has lost the nutritive elements which are sufficient to preserve to the zoösperm the vitality necessary for its fecundating power. This inference seems to be justified by the fact that in patients who are troubled with involuntary seminal emissions and in those whose blood is much impoverished from other causes, the semen derived from an organism which is too enfeebled becomes unfitted for fecundation, and this relation is so intimate that in jaundice the semen often assumes a marked yellow color. In the animal, as in the vegetable, we see ever this question of forces presiding over the great act of generation. In the plant fecundation only occurs at the time of flowering, which in its brilliant manifestations expresses its period of greatest development and vitality, and experience proves beyond doubt that the formation of the fruit and of the seed which it contains for the reproduction of its parent involves the greatest organic drain. Wise cultivators know this so well that they are careful to despoil the young trees of the whole or a part of their fruits, the too abundant production of which might injure their growth.

In animals, especially in the mammalia, whose organization most closely resembles that of the human race, conception only occurs at the time when the blood is subject to a peculiar and characteristic excitement during the physiological fever of the rut. Endowed with the sole privilege among organized beings of always being capable of procreation during the entire period of virility, which includes more than half of his life, man must submit in a still more marked manner to the general physiological law which imposes that the highest degree of force in the organism shall be employed to assure healthy and vigorous reproduction, and thus the continuation of life. In spite of her passive rôle in conception, woman also furnishes a proof that sufficient force is needed to assure this; we observe a direct proof of this, in the striking fact of the

diminution and even the temporary suppression of the menses when the latter are affected by depressing influences which might injure them. These physiological manifestations are only the natural result of anatomical changes which progressively appear in the structure of the testicle itself, which, toward the age of fifty, presents a marked diminution in size and undergoes a steady retrogression which gradually leads to atrophy, following in this respect a more or less rapid course according to the amount of vitality in the given constitution. According to Dr. Arthaud, who has made an excellent anatomical study of the senile testicle, this atrophy is characterized by a sclerosis of the tissue surrounding the tubules (its most marked peculiarity), a gradual disappearance of the epithelial element and a varicose dilatation of the ducts of the epididymis; these changes are the result of the vascular lesions and the imperfect nutrition of the seminal gland in the aged. Their course is usually slow and gradual and causes a positive result only in extreme old age; it is naturally retarded by the more or less healthy condition of the constitution in each subject or is accelerated by the relative severity of the diseases from which the individual has suffered and the more or less violent moral strains of life. This conclusion is forced upon us by the fact that of all the secretory organs the testicle is the one that exhibits the highest degree of activity, and consequently demands the most abundant nutrition.

The changes in the senile testicle induced by advancing age are, in an inverse sense, analogous to those which take place in passing from the period of infancy to that of puberty. As the organism advances toward virility, the amount of connective tissue increases, the calibre of the seminal ducts enlarges, so that its contractile power is notably increased, and the epithelial element has an increased extent and activity, which, from their insignificant condition in infancy, gradually become more and more marked and finally acquire their perfect development at the period of virility.

It is quite evident that the physiological phenomena which occur in the body, and which are only the corre
pression of the succeeding change in the intim
of the blood and organs, have a well-defin
ment, and that the evolutions of age

striking manner its most apparent manifestations, serve no other purpose than to distinguish and differentiate the principal phenomena of life in its two most important changes—that of progressive growth advancing to its acme of virile development, and that of the more or less rapid decline which ends with death. Life is centred in the nutrition of the organs and of the tissues which compose them, as well as in the blood which sustains and vivifies them. The progress of science will some day, perhaps, enable us to know exactly how the work of intimate nutrition which presides over the advancement of the organism takes place, as well as over its more or less rapid decline, and to note even the physico-chemical changes of the organic cell in all the periods of its existence; there will ever be left to discover the first cause which governs the progressive development of the organic tissues and the blood, and then their more or less rapid dissolution quickly leading to the extinction of their last vital manifestations—death. This cause, the wherefore of life and of death, remains unknown to us, and if death is generally the supreme expression of our final anguish, it remains also our final problem.

In woman the ovaries present in their process of formation a similar course to that of the testicle from infancy to maturity; but, at the time of the menopause, the manifestations are entirely different, in the sense that the disappearance of the menses, which is its natural consequence, coincides with the cessation of the secretion of the ova and hence causes the immediate and absolute loss of the procreative faculty; nevertheless, the analogy is striking, and even in antiquity they were designated by the very expressive name of the testicles of woman (*testes muliebres*), an idea which was just and sagacious, because we cannot insist too strongly upon this capital point that the whole process of conception consists in the impregnation of the ovum by the zoösperm of the seminal fluid, and that the entire complex and marvellously arranged organization of the reproductive apparatus of the two sexes has no other purpose than the preparation and accomplishment of this.

No one is ignorant of the fact that the ablation of the testicles in man, and that of the ovaries in woman, invariably causes absolute sterility in both. The close resemblance between the two organs, leads us to entertain seriously the

thought that expulsion of the ovum from the Graafian vesicle, like that of the semen, occurs under the influence of sexual excitement and of very violent emotions alone, since well-formed ova have been found in virgins. This inference seems to be entirely justifiable; since every-day experience shows clearly that fecundation can occur at any time during the period of maturity, we must admit that the ovule must always be ready to be impregnated by the zoösperm, and, to prove this it was necessary to ascertain if the Graafian vesicles which contain the ovum rupture during the intermenstrual period.

In order to settle this question, it was necessary to examine a number of ovaries recently removed from the cadaver or from the living subject, and to note the condition of the corpus luteum on the several days succeeding the menstrual period. Leopold has examined with this view twenty-five pairs of ovaries and has demonstrated the fact that at every moment during the intermenstrual period, rupture of a Graafian vesicle and expulsion of an ovum may take place. This experience is absolutely decisive and justifies the comparison of the physiological functions of the reproductive apparatus in the two sexes. L. Ruge, of Berlin, has thought that the objection should be raised that in the majority of the cases observed by Leopold the normal physiological conditions of the ovaries were altered either through the disease or in consequence of post-mortem changes; but, his objection is valueless if, as Leopold affirms, he only included ovaries which appeared to him to be extremely healthy.

There is a very old saying, to the effect that just after the cessation of menstruation conception occurs more readily and hence is more frequent. The statement is an exact one and is very well explained by the sensible (though temporary) descent of the womb which results, and still more by the physiological condition of the cervix, which, being naturally more dilated after the passage of the menstrual blood, renders much easier the introduction of the semen into the uterus. There is no longer any doubt that the congested condition of the female genital organs at this time favors the formation and expulsion of a larger number of ovules.

The physiological fever of the rut in its imperious manifestation is absolutely beyond the control of every sentiment

of morality, as well as every consideration or provision for the consequences of the generative act; it is the genesic instinct in all its brutal expression. It is quite different with man and woman, in whom the most ardent passion is subject to religious, moral, and social laws from which it would be very difficult to emancipate it. Marriage, which responds to those noble aspirations that are so intimately interwoven with the very essence of the human constitution, may be considered as the corner-stone of the entire social edifice of civilization;· but here, as in all the phases of life, the chaff is too often mingled with the good grain and deplorable abuses too frequently impair acts that are nevertheless accomplished in full accord with the dictates of conscience and reason. The man who marries in the full possession of his powers has no other purpose than the creation of a family, and the assuring of its material and social existence through his labors; this is so far his ruling motive that as a rule he does not marry until he feels assured that he can accomplish this, that is, when he has acquired a sufficient competence. On account of these motives, especially in France, marriage takes place far too late from the important standpoint of the increase of population, which presents an alarming deficit when compared with that of our neighbors. Besides, during the procreative period of marriage, which is already so shortened, in consequence of his proud aim to leave a larger heritage to his descendants and also to preserve his luxuries and to carry out ambitious views, the husband imposes upon himself an unnatural restraint which still further diminishes his posterity. This voluntary violation of one of the most imperious laws of the body may, nevertheless, be justified when the number of children exceeds the resources of the father, upon whom it seems hard to impose the task of begetting more children than he can support. However justifiable moral control may appear in this case, many refuse to admit it, seeing in this a false principle, because, especially in civilized countries, it is difficult to deny that human capital surpasses all other in productive labor.

In view of the frightful mortality of young infants, we can readily conceive that certain economists severely blame the self-interest which induces voluntary sterility; as for the moralists, who condemn it absolutely, I think that the honorable man is the best judge of the secret motives which ought

to guide his conduct in such a delicate matter, and no one can reproach him with imposing upon himself a necessary moral restraint in the presence of a companion too severely tried by severe confinements and whose life might be jeopardized by another pregnancy.

But, when this moral restraint is not justified by a weighty motive, it is only one of the forms of conjugal onanism; it is not only very reprehensible from every point of view, but is, according to many physicians, one of the most active causes of the progressive paralysis which for some time has been spreading so widely, corresponding with the more or less injurious influence which this deplorable violation of nature exerts upon the cerebro-spinal system in man; and usually the man alone is not injured, but his children are also more or less affected, as is very clearly shown by the subsequent disturbance and enfeeblement of the nervous system from which they suffer. A distinguished statistician, Dr. Chervin, has stated that in the departments of Eure, Oise, Orne, and the Lower Seine, where families have less children, the number of recruits discharged from the military service is the greatest. Thus in families with a smaller number of children the latter are feeble or sickly, while in those who have many they are usually healthy and vigorous. According to good observers, this violation of the laws of nature would seem to exert a deplorable effect upon the nervous system of the female, who, being rudely deprived of her physiological satisfaction, suffers a more or less severe shock the effect of which is felt principally in the organs the functions of which are harshly and abnormally excited; the uterus, its functions being unsatisfied, in the course of time undergoes serious changes. Every function being diverted from its physiological purpose, produces changes in the body which are more or less marked, nature everywhere and always sacrificing the individual to the species.

CHAPTER III.

At the end of the critical period, which follows the period of virility, the power of procreation is lost; this is the most marked evidence of the decline of vitality in the blood and organs, and inaugurates very plainly the gradual decadence of the body, the more or less rapid course of which varies with the amount of vital resistance peculiar to the latter, or, as the fatalists say, with each one's lease of life.

The phenomena peculiar to it present in the two sexes, as is the case with those of the virile period, very different characteristics. It usually makes its appearance between forty and fifty in woman, presenting, however, numerous exceptions below and beyond these ages; it is sometimes accompanied by disorders of the blood and nervous system, which are so distressing that several authors have called it the "hell of women." This opinion is not only exaggerated, but it is in most instances entirely untrue, since, although some women are at times much disturbed, the majority escape with minor troubles which are quite endurable, and a few experience no inconvenience whatever. Moreover, we must not forget that this period in the life of woman is a complete evolution in her constitution; it is also a veritable completion of her period of maturity which is usually favorable, since it does not increase to any extent the percentage of mortality observed at other periods of life, and when once passed it continues to assure to her greater health and longevity than to man.

In the latter, in fact, the critical period (which occurs between fifty and sixty, and which as in woman is hastened or retarded according to the constitution of the individual) is ordinarily more dangerous and that to a marked degree, which it is easy to understand by consulting the table of survivals in the two sexes at each age which I have already given. This fact may appear singular, considering the superior power and organization of man; it is, however, explained

very well, first, because it occurs later, and above all by the careful observation of the manner in which the period of maturity is completed in each sex. In woman the complete cessation of the menses entails immediately and absolutely the loss of the procreative power, and the chemical composition of her blood undergoes the characteristic change which causes it to resemble so closely that of man. It is entirely different with the latter, in whom the persistence of the seminal secretion causes a depression of the powers to which woman is not subjected, by reason of the entire cessation of menstruation. But, while nature secures to man for a longer period than she does to woman the privilege of a relative maturity, she is far from showing him more favor, and she seems to me to treat him more harshly, since the favor of a longer life which woman enjoys at every period in her life is still more marked in her at the critical age. A wide-spread belief, especially among women, is that man enjoys a happier life by reason of the superiority of his physical and intellectual constitution and the greater social and political importance which it assures to him. These advantages are unquestionable, but he pays for them very dearly, since his life is shorter, and the women who envy him these may certainly find in them a severe substitute for the pains and dangers of maternity. A substitute very hard and burdensome, in fact, since life is so sensibly shortened by it. Numerous physical, moral and social causes conspire to bring about this sad result. At first, contrary to woman, whose domestic occupations are usually little changed, man at this period in his life finishes his active career, abandoning the offices or employments which occupied him, or giving up business after having acquired a competence, and some a fortune. Hence results in nearly every case a considerable change in his habits and mode of life, which necessarily causes a physical and mental disturbance, that is often very dangerous, especially in the case of those who do not know how to create for themselves at the time an occupation of such a character as to preserve the advantages, or rather the necessity, of physical and intellectual labor. If the body and mind remain idle, there usually results a profound ennui, the inevitable consequence of which is the destruction of the physical and moral equilibrium of the body and the serious disturbance of the most active and

highly-endowed natures. Besides, it is a fact commonly noted by physicians who have grown somewhat old in the practice of their profession, that for the majority of them that time is truly critical, and this is especially true in the case of those who abandon their career while still young and vigorous.

If the consequences are so serious among the cultivated classes of society, who enjoy sufficient comforts, they are still more injurious for the mass of the population who live by manual labor in the fields or by numerous industries in the city; but, among the former, from an entirely different reason, it is the sudden suspension of work which causes such a serious disturbance of the constitution, while, on the other hand, it is the incessant and severe labor at the time when his strength is so sensibly diminished which decimates the workingmen.

Whether a man is young and vigorous, or is weakened by illness or by the natural decline of old age, equalizing labor entails in all the same expenditure of force, while ordinary common sense clearly teaches that this expenditure of force in the body should be proportioned to its effective power and that if it were otherwise there could only result prematurely a more or less rapid using up of the vital power in those whose strength can only be sufficient for the demands of labor. We understand and bitterly deplore this violation of the laws of Nature, who cruelly revenges herself by the number of diseases and deaths which inevitably follow, and society is almost powerless to arrest a scourge more destructive in itself than all the epidemics combined, by reason of its deadly and unceasing effect upon workingmen of every class throughout the world. The imperious necessities of life, which lead to the competitions of commerce and industry, the ravages due to the terrestrial and atmospheric disturbances which exercise such an important influence upon the products of agriculture —all these unfortunately conspire to force human labor into its painful struggle for existence, and in this struggle, that is without truce or quarter, how many generations have succumbed in trying to secure to their descendants an existence a little less harsh, but still precarious, thus following unwittingly that mysterious law of the continuous extension and perpetuation of life!

To the too lengthy list of causes which wear out the body

we must add the deplorable consequences of the passions and vices that shorten so considerably the duration of life, which, according to the most reliable physiological data, ought to reach a hundred years; the number of octogenarians is already very small, nonogenarians are the exception, and the centenarian is, by reason of his extreme infrequency, a veritable phenomenon. But, we must acknowledge that man, as a rule, leads a life which conforms in the least possible degree with the laws of hygiene; he does not live, he seems to be trying to destroy himself in every possible way. To all these open wounds of humanity, we must add the poverty which is generally their natural consequence, and which at times threatens to involve and destroy all. The problem of his total extinction is unfortunately almost insoluble, because it is affected by causes and reasons which are too numerous even for the mind of man; the poor will always exist.

However, it is consoling to note that their number is gradually diminishing, in spite of its inevitable variations, by reason of the constant advances which have been made in commerce, industry and agriculture, thanks to the light of science, which, growing daily brighter and more life-giving, makes itself manifest by the increased comfort of the public.

Many wise and acute minds have devoted their entire intelligence and extended study to a search after the best means of relieving the physical and moral sufferings of the outcasts of society, and, thanks to their laborious and incessant efforts, the whole gravity of the social problem to be solved has been frankly and clearly exposed, just as everything good and really practical that has been done to relieve so many misfortunes of every sort, has been admirably set forth, and also as all that remains to be done has been investigated and described with the most earnest care. Slavery, the most hideous of the plague-spots of humanity, the one which involves the most pain and humiliation of every sort, while at the same time it is the most active factor in depopulation, devours Africa to a frightful extent. In response to the powerful and earnest appeal of a Frenchman, Cardinal Lavigerie, a grand crusade is being organized for the purpose of opposing and destroying it; however difficult and arduous may be the task, civilization cannot shrink from it, and owes it to herself to accomplish it. The French Academy could not remain indifferent to the im-

mense results which were long since accomplished in the direction of this useful and noble work, and was happily inspired to receive into its membership, Maxime Du Camp and the Count d'Haussonville, the eminent writers and indefatigable explorers who have devoted the highest courage and talent to the most extended and profound investigation of this great subject.

The critical period in man corresponds precisely with that in woman; the latter usually marrying from seven to ten years earlier, the result is that the sexual approaches of the married pair, after gradually becoming less frequent, then cease entirely. Moreover, sexual love rarely persists at this time, because it is diminished by reason of the sensible decline of the vital forces, and besides it is deprived of its natural sanction, the procreation of children, from the moment when woman ceases to menstruate. Love has been superseded in the united home by a profound feeling of tender and trusting friendship which is sweetly preserved by the remembrance of the pure, soft joys of the past and the affectionate cares which are entailed by the direction of the moral and material interests of the family. When these elevated sentiments exist, as they do in well-balanced natures whom a wise purpose of preservation maintains within the limits of continence favorable to health, the critical period is passed almost imperceptibly, without exciting too evident disturbances of the blood and organs, especially if the physical and moral obstacles encountered during life have not been too numerous and too severe.

But unfortunately we must say that the favorable mental condition of man at the critical period is far from being the rule, and that this too-evident diminution of his virility has the deplorable effect of frequently occasioning with the majority a deep regret and of leading them, by a more or less violent impulse, to oppose this gradual decline of sexual power, and hence to do violence to nature by stimulation which is often very dangerous. The more or less marked return of the virile functions under the influence of various stimulants, if the imprudent are unhappily impelled to use them, at first arouses in them the greatest satisfaction; it seems to them as if their powers had ceased to decline and they had regained their vital force. But the illusion is brief, the body has its inflexible laws, and sooner or later they repent of their violation

because the speedy depression which follows is of the same intensity and duration as the unnatural excitement. In fact, by the too habitual and too frequent abuse of the sexual act men who have reached the critical age of fifty or sixty poison their declining years and shorten their lives. If some favored constitutions can enjoy with comparative impunity the pleasures of love up to a somewhat advanced age, the great majority, even of the healthy and robust, generally suffer if they exceed the physiological limit. But, when former diseases, hereditary taints, or the hard struggles of life have enfeebled the body, venereal excess then becomes really deadly.

The physical and moral condition of woman is in every respect much more favorable. The menopause, while entailing the sudden and absolute loss of the generative power, conveys to her the inward sense of the fact that she has lost the chief attraction of her sex and, as it were, the dignity of the sexual act. Hence results a diminution of her passions, which gradually becomes more marked, and all the goodness and nobility which Nature has implanted in her is concentrated more and more in the affectionate aid which is given to her husband, her partner and natural guide, in his constant struggle for the means which are best adapted for the favorable execution of the plans necessary to secure the fortunate establishment of his children and thus the completion of the entire work of generation. These cares agree remarkably with those of the household, which usually remain nearly the same, and thus give to her life that nearly constant uniformity of physical, moral and mental expenditure which are habitually wanting in man.

A wave of opinion, which is temporarily on the increase, leads women at the present day to desire to change the domestic and social condition with which our mothers and grandmothers were content; it is more than doubtful that if these aspirations were satisfied women would derive from them more real independence, and above all more happiness. Moreover, it is greatly to be feared that, in undertaking the arduous labors of the anxious and troubled life of man, for which Nature has ill equipped them, either physically or morally, they would continue to derive from her the inestimable favor of a longer life.

They would act wisely and with foresight if they left to man the power and the hard lot which she bestows upon him

in life, and if they kept for themselves the precious gift of the grace and charm in which lies their true power over his heart, which he desires and acknowledges most willingly, being assured that he finds there the mild and gentle source of the noble and sympathetic feelings which make him better.

The critical period in woman is ushered in by signs which are too clearly marked not to have been carefully observed by physicians throughout all ages with reference to its influence upon the progress of diseases which may supervene during its course (sometimes quite protracted), and the hygiene and pathological questions with which it may be involved need only be mentioned.

Since, as we have stated, the critical period in man leads to more serious physiological and pathological results than in woman, it follows that a heavy obligation is laid upon the physician to note more carefully than has hitherto been done from this special standpoint the acute, and especially the chronic, affections which may develop and present at this period of life a gravity that is frequently formidable. He should make him feel deeply the urgent necessity of observing a wise continence and also impress upon him forcibly the strong necessity, from every point of view, of creating for himself an occupation which is fitted to his tastes and to his physical and intellectual abilities. The clearly-defined difference between the physiological and pathological phenomena in man and woman during the period of maturity is also marked during the critical period; it is plainly marked because it preserves in each the striking expression of their sexuality. The formation and the propagation of the human seed is the duty of man, its preservation and fructification that of woman, the result of their combined physiological action being the continuance of life.

Everything proves that Nature knows no law that is more general and is better obeyed than that of universal procreation, and by continuing the period of virility in man and woman for nearly three-quarters of their lives, she again shows in a striking manner the providential purpose which she always follows without deviation. Some bold minds, too much inclined to exaggerate the influence of cosmic causes, have gone so far as to think that death itself might in the order of nature be only a lesser degree of vital heat, a more or

less transient coldness—which would be to deny its existence entirely, at least so far as regards the essential features by which we recognize it.

We may affirm, with a consoling certainty and a reverent wonder, that death, in spite of the general idea of annihilation which is so profoundly painful, is nevertheless powerless to destroy forever the perpetual renewal of life and the eternal propagation of thought and desire. In spite of the harsh statement of facts, we cannot deny that love is not only a striking protest against the absolute dissolution of the individual, against death, but that there is every evidence that it is his all-powerful vanquisher, since it assures, in spite of death, the continuance of life; and this undoubted victory of life over death goes on increasing and becoming more assured by reason of the wonderful progress which the conquests of science have effected in public and private hygiene, and also through the progressive improvement which the immense developments of industry and commerce have brought about more and more in the condition of the masses, the natural result of which is the gradual increase in their numbers.

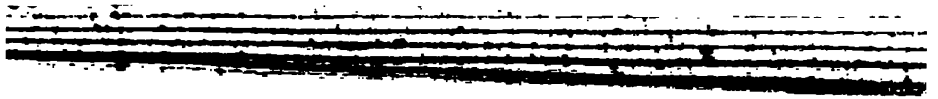
Paucibus mundum, the world belongs to a very few favored individuals, said Horace sadly, describing in two words the terrible social, moral and political condition of his day; we may say to-day in all truth that the modern world belongs to quite a large number, feeling assured that the intellectual and economic improvement which continues to summon an increased number of guests to the banquet of life will ever go on advancing. However, this natural result of real progress cannot become positively certain except under the express condition that a gnawing corruption shall not arrest its onward march; history in this regard possesses an irresistible eloquence in furnishing us with the undeniable proof that the fall of the most flourishing empires has no more potent cause. If, as everything leads to us to infer, life is creation, it is clear that the generating of it is its most striking manifestation, since it continues throughout all time; of all scientific questions generation is certainly the most important, and the one which seems to pervade all of them with its powerful and mysterious inspiration, and to express in the most startling manner the problem of life, a problem doubtless forever insoluble, though this does not prevent us from studying all

the questions which are included under human knowledge. Thanks to this same passion for knowledge which animates the mind of man, a passion which is as noble as it is irresistible, and which is certainly the most useful of all, the questions which belong to the vast domain of human learning are the object of the most earnest and laborious studies and researches. Through what remarkable prejudice do *savants*, even those who are most sincerely devoted to the triumph of the useful and brilliant discoveries of science, regard philosophy with such peculiar disdain? This is a very unjustifiable piece of intolerance, because if it must be admitted that to establish firmly scientific facts it is generally necessary to first examine separately the different parts in order to study them thoroughly and completely, there comes a time when the parts are only understood by their relation to the whole, and the necessity of generalizing the facts that have been acquired is logically imposed upon us. Philosophy, being in fact only the methodical study of the collection of facts furnished by all the branches of human knowledge, is able by itself to explain the higher cause, and thus to satisfy more fully and completely that knowledge of things which gives to the savant such worthy claims to the respect and sometimes to the admiration of the world.

In spite of the surprise and the painful impression which independent minds very properly experience on this account, there is nevertheless a just pride in affirming that there is no passion more elevated and more noble than that of devotion to science; there is none that gives to the true scholar keener and purer pleasure, there is none that gives him the true sense of his dignity and position which is exalted and positively unequalled in the hierarchy of living beings.

It is again to the passion for knowledge, which animates with such a powerful inspiration the rare and exceptional intellects which are the torch of the human mind, that we owe those admirable works which exercise so important an influence upon their contemporaries. It is that which we see realized for philosophy in Descartes's "Discourse on Method," for theology in the "Provincial Letters" of Pascal, for history in Voltaire's "Essay on Morals," for jurisprudence in Montesquieu's "Spirit of the Laws," for natural history in Buffon's works, and for physiology in the wonderful discoveries of

Claude Bernard. If books, like men, have their destiny, the general impression, nevertheless, prevails that as a rule the least doubtful characteristic of genius is precisely the dominant influence which its works exercise upon the intellects of their time, which bear its visible and permanent impression.



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